THE
INTERNATIONAL SUGAR JOURNAL

VOL. LX JUNE, 1958 No. 714

NOTES AND COMMENTS

International Sugar Council.

The International Sugar Council met in London on 22nd and 23rd April, 1958, under the chairmanship of Mr. D. J. MUIR (Australia). The meeting was attended by delegates from twenty-four countries and by observers from five other countries and from the Food and Agriculture Organisation of the United Nations.

The Council noted that twenty-two countries had ratified the Protocol amending the International Sugar Agreement. This includes the Republic of Indonesia which has acceded to the Agreement as amended by the Protocol and deposited its instrument of accession on 21st February, 1958.

The Council took note of a revised estimate prepared by its Statistical Committee of free market requirements for the calendar year 1958 amounting to a total of 5,610,000 metric tons, raw value, as compared with its previous estimate of 5,515,000 metric tons, raw value.

The Council considered the progress made in connection with the arrangements for the negotiation of a new International Sugar Agreement at a conference to be held under the auspices of the United Nations in September, 1958.

The Council took note of the fact that Miss M. D. SHUFELDT, on reaching the age of retirement, had recently left the services of the Council. Miss SHUFELDT had been closely associated with the work of successive Sugar Councils since 1931 and had lately been Adviser to the present Sugar Council. The Council placed on record its warmest thanks to Miss SHUFELDT for her long years of devoted service.

The next meeting will be held after the International Sugar Conference unless circumstances make an earlier meeting necessary.

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U.S. Domestic Quotas 1958.

A reflection of the anxiety felt in the U.S. as a result of the Hawaiian sugar strike is given by the deficits declared on April 23rd and at the beginning of May, each of 100,000 tons. At the same time, deficits were declared in the Puerto Rican supplies, the first of 200,000 tons and the second of a further 50,000 tons. These have been the result of reduced yields, owing to drought. Details of the individual quotas as adjusted are as under[1]:

Raw sugar value	*Short tons*	*Long tons*
Domestic Beet	2,088,306	1,864,559
Mainland Cane	642,593	573,744
Hawaii	865,513	772,779
Puerto Rico	864,130	771,545
Virgin Islands	15,193	13,565
Philippines	980,000	875,000
Cuba	3,157,880	2,819,536
*Other Foreign Countries ..	186,385	166,415
	8,800,000	7,857,143
*of which		
Peru	55,588	49,632
Dominican Republic	51,757	46,212
Mexico	34,209	30,544

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Cuban Crop Tonnage.[2]

News that members of the Cuban Sugar Institute were to meet in Washington to discuss with the Department of Agriculture the suggestion that the decreed crop of 5·5 million tons should be increased to provide an additional reserve for the United States in view of the Puerto Rican and Hawaiian shortage was a little unsettling to the market at the beginning of May.

Subsequent information that the Cuban Institute had recommended an increase of 100,000 tons (since approved by the President) had little or no effect on the market. It cannot be said that the trade regarded this addition in a particularly favourable light from a market point of view and the steadiness which followed was more a reflection of the market's relief that the increase was not larger.

This 100,000 Spanish tons has been placed to the U.S. Retained Quota. This quota, originally established at 500,000 tons when the crop was decreed, was reduced to provide for the 116,035 Spanish tons reallocated to Cuba when the first Puerto Rican and

[1] C. Czarnikow Ltd., *Sugar Review*, 1958, (354), 88.
[2] C. Czarnikow Ltd. *Sugar Review*, 1958, (353), 84.

Hawaiian deficits were declared on April 23rd, thus reducing it to 383,965 tons.

Cuba receives 80,438 short tons, equal to about 70,820 Spanish tons, of the second Hawaiian and Puerto Rican deficit. Assuming that Cuba makes an immediate transfer of this from the Retained to the Free quota, the stock in reserve to provide for any further losses of production in Hawaii and to take care of any increased quota accruing from an expansion of U.S. consumption above the figure at present provided for would be reduced to 413,145 Spanish tons.

This would seem to be fairly comfortable allowance for these contingencies and it might have been expected that the U.S. domestic market would have reacted slightly to these additions to the effective supply. The obvious nervousness of the United States Administration concerning the Hawaiian position had no doubt communicated itself to the market and prompted the expectation of further deficits as the strike continues.

These additions to Cuba's outlet in the American market have no direct bearing on the World Open Market position but they are not without their sentimental influence. It is by no means unlikely that further calls will be made on Cuba for there are no indications at present of any early settlement of the dispute ; indeed, it has been stated that it may drag on for some months. Should this prove to be the case and further substantial inroads were made into Cuba's reserves it would not be without benefit to World Market feeling.

Cuba will have no difficulty in making the additional 100,000 tons. The cane burnt by rebels will not affect production as the quotas of any mills concerned have been transferred to others. A number of mills have finished manufacture of the decreed sugar crop but some of these, grinding for the production of high test molasses, and those still grinding for the basic sugar crop will be available to make this extra sugar.

Whilst cane burning by rebels will not be allowed to affect production, sugar in warehouse destroyed by rebel activity will not be replaced. No reliable estimate of the total quantity destroyed has yet been made but definite losses have been reported.

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West Indies Sugar Co. Ltd. 1957 Results.

In contrast to Monymusk, where a six-week strike caused a loss of production which could not be made up, Frome had an excellent crop which was harvested without incident. Bulk sugar handling equipment was installed at Savannah-la-Mar and began operating in December 1957. The installation of a second mill at Frome so as to increase capacity and shorten crop will be completed for the 1960 crop. Sugar production at Monymusk was 59,431 tons, compared with 69,961 tons in 1956, while Frome produced 83,772 tons as against 69,713 tons in 1956. A final dividend of 1s 1d, free of tax, makes a total distribution of 1s 4d per share, free of tax, compared with 1s in the previous year.

Sugar Situation in the French Union.

Sugar supplies from the 1957/58 sugar crops total 1,894,577 metric tons, refined value, according to a recent survey[1], including 1,415,499 tons produced in Metropolitan France, 199,680 tons in Réunion, 54,398 tons in Madagascar, and estimated crops of 90,000 tons, 130,000 tons and 5000 tons, respectively, from Martinique, Guadeloupe, and the French Congo. Requirements over the same period total 1,868,540 metric tons, refined value, and include 1,260,000 tons for Metropolitan France, 200,000 tons for Algeria, 68,950 tons for Tunisia, 156,615 tons for Morocco and the remainder for other French possessions, etc. With an initial stock of 10,000 tons, the above figures would result in a carry-over stock of just over 36,000 tons.

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Swedish Sugar Production, 1957.[2]

Sweden's 1957 sugar beet crop was satisfactory, a total of 2·1 million tons of beet being harvested as against 1·8 million tons in 1956. The yield per hectare averaged 39 tons on a total area of 53,600 hectares which was 3000 hectares larger than the year before. The sugar content, however, was lower than in 1956 and amounted to only 16·9%. Sugar output was about 6 tons per hectare, raw value. A total of 331,000 tons of raw sugar was produced, including 322,000 tons from beet grown in Sweden and 9000 tons from beet grown in Denmark. In 1956 total raw sugar production amounted to 292,000 tons.

From 1st January 1958, the import duty on sugar (until then varying with the world price) took effect with fixed rates. These are 25 kroner per 100 kilos of raw sugar, 33 kroner per 100 kilos for refined, 29 kroner for syrups, and 1·6 kroner per 100 kilos of washed beet.

* * *

Sugar in Swaziland.[3]

Sugar cane is grown in two centres in Swaziland—at the irrigation scheme off the Komati river to the north of the Peddie district, and in the Big Bend irrigation scheme of the Usutu river. Milling quotas of 40,000 tons each have been allocated to Ubombo Ranches Ltd. at Big Bend and to Mhlume (Swaziland) Sugar Milling Co. Ltd. in the north. The latter Company has been formed by the Colonial Development Corporation and Sir. J. L. Hulett & Sons Ltd., and will build a new mill costing £1,750,000 as part of a £4 million development scheme. Cane will be grown on Company land irrigated by the C.D.C.'s 42-mile canal which was formally opened last August. A Swaziland sugar control board will be set up, consisting of government officers and representatives of millers and planters, and the board will in future handle the question of sugar growing quotas.

[1] *Sucr. Franç.* 1958, **99**, 74.
[2] *Zeitsch. Zuckerind.*, 1958, **83**, 41–42.
[3] *S. African Sugar J.*, 1958, **42**, 59 ; *Public Ledger*, 22nd March, 1958.

ECONOMIC ASPECTS OF CANE CULTIVATION IN THE EASTERN GANGETIC PLAIN

THE area considered here embraces those portions of Bihar and Eastern Uttar Pradesh which lie in the Gangetic plain, which tract is, par excellence, the centre of cane cultivation in India. The economic problems presented by this tract are succinctly summed up in the recent statement[1] that improvement of the cane crop in eastern Uttar Pradesh is rendered difficult owing to the smallness of the holdings and the poverty, and consequent backwardness, of the peasants themselves. The reason for this backwardness lies partly in the fact that here is the most densely populated tract of India and partly in history. It lay on the Eastern border of the Moghul Empire where the Central authority was never fully established and power became vested in a zamindari (landlord) element, the members of which controlled large areas, divided almost in their entirety into peasant holdings averaging some 2½ acres each. That position was stabilized with the Permanent Settlement of Bengal in 1793 when the tract became the centre of a flourishing indigo industry run on the basis of a certain area of "khud khast" (direct cultivation by landlord) round the factory but with the mass of the crop grown by tenants.

With the turn of the century the Indian indigo industry suffered a reverse through the growth of the synthetic industry, and during the first decade or so of the present century sugar cane came to supersede it as the major cash crop of the tract. Some indication of the poverty at that time of change will be gathered from the fact that the daily wage of a field labourer was ¾d; of course, prices of essentials such as food grains had not reached world level, but the standard diet was of the coarser grains and few peasants were consumers of wheat. It was this pre-existence of an indigo farming system which enabled a cane industry, based on central factories employing the vacuum pan and producing white sugar in place of gur, to develop with greater ease than elsewhere in India. But the system had its disadvantages, more prominent in the case of cane than of indigo which was a leguminous plant not needing the degree of fertility required by the former if high yields are to be obtained. Factories were dependent on a mass of individual peasants, mostly in debt and all lacking the capital to change the cultural system; fertility remained low and small advantage was reaped from the varietal changes brought about by the introduction of Co canes.

The limiting factor here to increased production was lack of capital, the provision of which of itself, however, could accomplish little; ignorance of any but their standard cultural methods developed through the ages, and inability to adopt newer methods, even if understood, owing to the smallness of the holdings added to the difficulties. There are two ways of dealing with such a situation, both necessarily slow; they are covered respectively by the terms co-partnership and co-operation. The former requires for its successful operation an "over-lord" of a considerable area who may be a person, landlord or "zamindar", or an impersonal body such as a land-holding, registered company. In the tract under consideration the stage seemed to be set for co-partnership development, for it was here that the zamindari system, with its large estates and wealthy zamindars, was strongly entrenched. That development did not follow these lines was due to the historical factor; the zamindars were either former independent rulers who had shaken off Moghul suzerainty, or tax-collectors appointed by the Moghul who, as the Moghul power waned, set themselves up as owners of the land and who were accepted as such by the British in accord with ideas of land-ownership as prevalent in England; what were in reality taxes on the land were accepted as rents.

To make this line of development effective, a change of mental outlook in the zamindari element was needed. Under this the zamindar would have become an active partner in the development of his estate, providing the capital which was beyond the means of the individual tenant-peasant and, in the case of cane, organizing all those cultural requirements for increased production, arranging ordered deliveries to the factories and sharing the added proceeds of the co-partnership enterprise with his tenants. It is the system which has been adopted so successfully in the Fiji sugar industry with this difference, that in Fiji ownership of factory and land were vested in one impersonal organization. At best, such a change of mentality would have been slow, the result of an educational process; in fact that process was never initiated in the area. On the contrary, following Indian independence, the zamindari system was abolished. In the circumstances, recourse to co-operation remained the only answer and the education of a mass of mainly illiterate and backward peasants in the spirit of true co-operation is even a slower process than changing the mentality of relatively few but generally educated zamindars. Of necessity, co-operative organization entailed a large measure of State control, the details of which cannot be given here, and the relative ineffectiveness is disclosed by the earlier quotation.

In recent years, however, another approach has been made to the problem, and it has its centre in Bihar; it may well lead to an agricultural reorganization which would have its repercussions on the cane industry of the tract. The approach is through what is known as Bhoodan Yagna (land-gift sacrifice) and its prophetic advocate is VINOBA BHAVE, the Elisha to GANDHI'S Elijah. The basis is entirely philosophic and a-materialistic, and its appeal to that emotionalism so easily aroused in the East but so difficult for the Western mind to grasp. Essentially it is an appeal to the owners of land through their emotions to

[1] *I.S.J.*, 1958, **60**, 124.

present land to the movement. That gifted land, which already amounts to many millions of acres, is then divided into peasant holdings and distributed among the landless peasantry. It is a movement entirely independent of officialdom except in one respect; the act of transfer is duly recorded in the official register.

It is not possible to enter into any detail here; the movement is described by R. P. MASANI in a recent book[1]. At first sight, it would appear to be entirely impractical, for the society it envisages is one which, in the minds of the authors, has no need for money and is dependent on subsistence agriculture. But that is not the real India; already there is a large urban population which has to be fed, there is a rapid increase in the number of mouths and there is the ever-present danger of a monsoon failure leading to famine. Subsistence agriculture and the production of *khadi* (homespun cloth), the latter an essential item in the philosophy of the movement, offer an insecure basis for meeting India's economic difficulties.

Yet there is much to admire and commend in the movement which is in its early stages and malleable. It will be for the enthusiastic band of disciples of VINOBAJI to mould the structure so that some higher standard of agricultural production than one of subsistence is achieved while maintaining the idealism which constitutes the strength of the movement. That the dilemma is realized, if only dimly, appears from two items noted in the book. "Land-gifts", it would seem, need not be outright gifts, for the zamindar may retain some not clearly defined interest. And grants of gift-land contain a clause making membership of a co-operative compulsory should such an organization be established for the village. It would seem, thus, that the way lies open both for co-partnership and/or co-operation. The movement, though spread throughout India, has its greatest impetus in Bihar, a tract which is also the centre of the sugar industry. That industry, above all others, is characterized by its need for the closest association with the agricultural system under which its raw product, sugar cane, is grown; for that system determines not merely the quantity but the quality of that product and the degree of freshness on its arrival at the factory. The fact that the sugar worked up in the factory from that raw product is disposable only on a cash basis necessitates an agricultural system not limited to the production of subsistence. Before the leaders of the sugar industry of the Eastern Gangetic plain and of the bhoodan movement lies a great opportunity, the opportunity of finding a solution to the intractable problem of raising, under a peasant system, soil fertility to an extent which will provide both subsistence and an excess of produce sufficient to meet the demands of a rapidly increasing population seeking a higher standard of living.

H. M.-L.

AGRICULTURAL ABSTRACTS

Interval Hot Water Treatment to Control Downy Mildew (*Sclerospora sacchari*). C. S. WANG. *Taiwan Sugar*, 1957, **4**, (6), 21–23.—Transference of diseased setts immediately from water at 48°C for 120 min to water at 52°C for 30 min completely eliminated the disease but incurred risk of killing the buds. Setts treated at 45°C for 60 min, dried and treated 24 hr later at 52°C for 60 min was equally effective and gave germination % of 56 (untreated 92·9) against 18·5 for the former treatment.

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Functioning of haploid gametes in the cross *Saccharum officinarum* × *S. spontaneum*. P. A. KANDASWAMY and J. T. RAO. *Curr. Sci.*, 1957, **26**, 217–18.; through *Plant Breeding Abstracts* 1957.—Three seedlings were obtained by crossing *S. officinarum* 'Vellai' (2n=80) with *S. spontaneum* 'Uganda' (2n=120). In some morphological characters, the hybrids were intermediate between the parents and in others they resembled one or other of them. All the seedlings had 2n=100; 50 chromosomes were visible at metaphase in the pollen mother cells of one hybrid. This indicated that in both parents haploid gametes had functioned.

Recommendations for Controlling Sugar Cane Borer. W. H. LONG *et al. Sugar Bull.*, 1958, **36**, 129, 130.—A summary is given of the recommendations prepared by a group of entomologists of the Louisiana Experiment Station and the U.S. Department of Agriculture. Biological control has yielded no clear economic gain in spite of the large sums spent. Cultural practices, such as cutting close to the ground and burning trash are merely helpful without giving real control. Reliance has come to be placed on chemical control with 2% "Endrin" in granular form or, if bagasse or field trimmings are fed to cattle, "Ryania" dust. First generation control is not economic and first application should be made when 2% of the plants (1 stalk in a 50 stalk sample) is attacked. Certain varieties, particularly N:Co 310, are relatively resistant to attack.

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Investigations on Individual Variations in the Virus-Transmitting Ability of Different Aphid Species. K. BJÖRLING and F. OSSIANNILSSON. *Socker Handl.* II, 1958, **14**, 1–18.

[1] *The Five Gifts* (Collins).

THE SUGAR CANE IN BRITISH GUIANA

ANNUAL summaries of the investigations carried out at the Sugar Experiment Stations for the years 1953–1956, respectively, are published in the form of Bulletins Nos. 22–25, issued by the Dept. of Agriculture, British Guiana. All four years had above-average rainfall, that of 1954 being 167·34 inches compared with a 30-year average of 102·58 inches.

Variety Trials

Preliminary or "sorting" trials cover three crops and four categories of varieties: seedlings imported from Barbados (B series), seedlings raised locally from fuzz received from Barbados (DB series), seedlings raised from local crosses (D series) and imported varieties including seedlings raised from fuzz received from Mauritius. On frontland clay only in the first ratoon crop did any varieties surpass the standard, B 41227; these were B 50112, B 5037, B 49119, D 13/52, D 44/52 and D 55/52. On pegassy clay B 49119 alone of the tested varieties, and then only in first ratoons, surpassed the standard.

The two outstanding commercial canes are B 37161 and B 41227, occupying 39·5% and 31·0% respectively of the total area under cane. Of the canes adequately tested, B 47258 alone appears to be likely to challenge the lead of these two. Of less well-tested canes, B 49119 shows promise but is, unfortunately, susceptible to leaf scald.

Growth and Ripening Studies

British Guiana has no sharply contrasted climatic seasons by which a harvesting season is rigidly fixed. With a change from the almost complete dependence on a single variety, D 625, in the early thirties to the cultivation of an ever-increasing number of varieties, the response of these to the environment becomes of importance in that, for instance, harvesting and with it manufacture might be extended through a longer period. The four varieties selected for observation were B 41227, non-arrowing and late maturing; B 37161, light arrowing and early maturing; D 158/41 and D 37/45, both arrowing heavily. The results of the plant cane crop are recorded in Bulletin 24 and of the first ratoon crop in Bulletin 25. The results are recorded as pol % cane and tons 96° sugar per acre at intervals from 9 to 15 months. There are considerable varietal differences in response and also in the response of arrowed cane to differences of rainfall.

Fertilizer Experiments

Leaf analysis has now become adopted as a measure of the nutrient status of the plant and as a measure, combined with yield, of fertilizer requirement. In the case of phosphorus, however, juice analysis appears to be preferable. Weather and soil type are shown to influence the relationship between leaf nitrogen and fertilizer dosage, while the response to increasing N diminishes with the age of the crop measured in number of ratoons. Of phosphate applied, only some 2–10% is recovered in the first crop, probably owing to fixation, but the residual effect is large and, in the first ratoons, the recovery may be as great as in plant cane. Interactions include a depression of phosphate uptake in the presence of ammonium sulphate. Interaction may also account for lack of accord between potash in the leaf and response to fertilizer. Lime, as giving an increase in phosphate uptake, is another example of probable interaction.

The results obtained with plant cane in the variety–fertilizer trials suggest a differential varietal response to nitrogen. In particular, D 37/45 shows an almost linear response to increasing applications in marked contrast to the remaining varieties, of which the results are strongly indicative of diminishing returns.

The Varietal Position

With the practical elimination of the once favoured variety, B 34104, which in 1951 occupied 67% of the total area, the varietal position remains unchanged with B 37161 and B 41227 the two dominant varieties. As a general field practice there is a slight but continuous trend towards a reduction in the area under plant canes.

Disease

The major and, in fact, only serious disease of the cane plant in British Guiana is leaf scald, which was first identified in 1950. The history of the disease and the work conducted on its study is recorded in Bulletin 24 by J. A. PIRES. All effort has been directed to finding varieties which carry a degree of resistance adequate for extended cultivation. To this end 275 varieties have been tested and listed under five categories of resistance.

H.M.-L.

J. & L. Harvester Demonstrated at Mossman. ANON. *Producer's Rev.*, 1957, **47**, (11), 2, 3.—The machine demonstrated was imported into Queensland from Louisiana. It successfully cut and topped 40 tons per hr. The attractive feature was the piling arm, by adjustment of which cane from up to six rows can be piled across the rows ready for gathering by a front-end loader.

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Measures to Control Giant Sensitive Weed. ANON. *Producer's Rev.* 1957, **47**, (12), 15.—The article records the introduction of an amendment to the Act granting powers to the Cane Pest and Disease Control Boards to exercise such control. Under the amendment the term 'pest', defined in the Act as insect, animal or bird, is extended to include plant pests.

Incidence of Beet Eelworms in Soil Samples Growing Beet in Cardboard Cartons. G. MÖLLERSTRÖM. *Socker Handl.* II, 1957, **13,** (3), 31–38.—No reference is made to the recent work of DUDDINGTON on predacious fungi as a control of eelworm and the control accepted is rotation of crops. During World War II, the demand for vegetable oils in Sweden led to large increase in area under rape and mustard, alternative hosts for the beet eelworm, *Heterodera schachtii.* A system of measurement of the intensity of soil infection by cultivation of beet in cartons is described, data covering several years are recorded and a scale worked out. Under this, an intensity > 300 cysts per carton in the year prior to sowing beet indicates a risk of catastrophe.

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Use of Soil Moisture Tensiometer for Regulating Irrigation. S. N. MEHRA. *Agric. Pakist.*, 1956, **7,** 332–337 ; through *Soils and Fertilizers*, 1957.—The irrigation interval for sugar cane during April was successfully increased from 10 to 15 days without reducing yields ; during earlier months an interval of 20–25 days was satisfactory. Clayey loams required more frequent irrigation than sandy loams.

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The Flora of the Cane Fields of the French Antilles. H. STEHLÉ and M. STEHLÉ. *Rev. Agric. Sucr. Rhum. Antilles Franç.*, 1957, **2,** 107–120.—Extracts are given from a forthcoming *Flore agronomique illustrée*, Vol. 1, covering the flora of the cane fields arranged in categories indicative of the ecological conditions.

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A Survey of Leaf Scald Disease in Martinique. J. A. SPENCE. *Rev. Agric. Sucr. Rhum. Antilles Franç.*, 1957, **2,** 121–126.—Leaf scald (*Xanthomonas albilineans*) was first identified in Martinique in 1955. The presence of the disease is confirmed and recommendations for its control given.

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The Reasons for Differences in Yield under apparently similar Conditions in Grande-Terre. H. STEHLÉ *et al. Rev. Agric. Sucr. Rhum. Antilles Franç.*, 1957 **2,** 127–134.—The differences disclosed have a local interest only ; what is of interest is the tracing of the ecological causes through a comparison of the floral categories.

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Experimental Cane Field, Plaine du Lamentin, Martinique. J. KLONINGER. *Rev. Agric. Sucr. Rhum. Antilles Franç.*, 1957, **2,** 135, 136. A brief record is given of the results obtained at the 4th ratoon harvest of a fertilizer experiment.

An Agro-pedological Classification as applied to the Cultivated Soils of the French Antilles. H. STEHLÉ. *Rev. Agric. Sucr. Rhum. Antilles Franç.*, 1957, **2,** 137–142.—The article brings together the results of prior investigations and links the classification with those adopted for other West Indian territories.

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Spraying 2,4-D on the leaves in Guadeloupe. F.-C. VAN EMDEN. *Rev. Agric. Sucr. Rhum. Antilles Franç.*, 1957, **2,** 143–145.—Preliminary trials with spraying from aircraft indicated sufficient improvement in juice quality to justify further trials. Unfortunately the machine crashed and the same author takes the opportunity to review, in another paper (pp 151–152), the various uses for aircraft in cane cultivation.

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Java Sugar Cane Reports. *Maandber. Proefsta. Java-Suikerind.*, 1957, (12).—A review of the sugar cane crop for 1957 is given, with acreages and yields of plantations or undertakings arranged in tabular form, some 73,000 hectares having been devoted to cane. Reference is made to weather and labour conditions during November. Owing to the prolonged drought, newly planted cane in many areas was in poor condition with leaves yellowing. Damage has been caused by stripe disease and gumming and also by insect pests, notably stem and top borers. Some undertakings reported appreciable damage due to wild pigs, monkeys and rats.

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Stem Borer in Bihar. *Proc. Ind. Acad. Sci.* (Sect. B.) 1957, **46,** 75–95 : through *Hort. Abstr.* 1958, **28,** 145.—A study has been made of the stem or moth borer *Chilo tumidicostalis* and its larval parasite *Apanteles flaviceps.* This borer causes serious damage, especially in heavy and badly drained soils. Ratoon cane is infected more than plant cane. Loss in cane tonnage over several seasons ranged from 8·2 to 12·6%. Different varieties of cane vary greatly in their susceptibility to this pest.

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Cane Varieties in Pakistan. M. O. JAN. *Agric. Pakist.* 1956, **7,** 349–358 ; through *Hort. Abstr.* 1958, **28,** 141.—Variety trials at the Sugar Cane Research Station, Mardan, and on holdings in the Peshawar Valley are summarised. Co 622 has given good results since 1950 and Co 644 has proved outstanding, having outyielded the standard variety Co 290 in tonnage, representing an improvement of 45% in the yield of sugar per acre.

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THE DETERMINATION OF SUGAR IN SUGAR BEETS

By Wm. H. PARKER, M.Sc.(Birm.), Chief Chemist, British Sugar Corporation Ltd.

PART III.

FROM what has been said in previous articles[1] it will be appreciated that the reaction of a set of saw blades to beet samples in any given condition may be expected to vary according to the sharpness of the teeth which in turn depends upon the number of samples which the blades have dealt with. The effect of the number of samples sawn on the results has to be watched closely.

Re-sharpened blades cannot generally be applied to as many samples as new blades and in the light of our experience are limited now to one re-sharpening only before being discarded, although we have had cases where sets of blades have been used after several re-sharpenings. The number of samples, however, which such blades can deal with diminishes with each successive sharpening.

The amount of brei collected also diminishes as the number of samples sawn gets greater and sometimes a set of blades has to be removed because the quantity of brei is inadequate for analysis requirements.

It is important that the teeth of the blades are kept free from blockage by brei. Otherwise pulp gets packed so hard in them that it is difficult to remove it and the efficiency of the blades is impaired. This is indicated by a reduction in the quantity of brei collected.

Gauges of 0·120 inches are used for testing the thickness of blunted blades at the periphery and blades which pass these gauges at more than four points are not considered fit for re-sharpening and are scrapped. Also all blades for re-sharpening have to be free from peripheral cracks and any signs of metal fatigue.

Comparative tests have been made in each campaign since the introduction of the saw machines with the following results.

Campaign	Differences in sugar contents found*	No. of samples tested
1955/56	0·02	1261
1954/55	0·05	1119
1953/54	0·07	1347

* Sugar in minced remainders higher on average by these amounts.

The results of tests made during the 1956/57 campaign are referred to in the next paragraph. All these tests were carried out using the standard H.W.D. method. The progressively closer agreement will be noted.

Analytical Procedure.

Volumetric methods using flasks for digesting are unsatisfactory because of the practical difficulties involved.

Extraction of the sugar by hot or cold water digestion based on the method of Sachs and le Dochte and the use of the saccharimeter were decided upon as the best method of approach.

The work is briefly described under the following main headings.

I. A "Reference" or "Double-Extraction" Method.

In the past many attempts have been made to establish an absolute or standard method of analysis which is independent of marc content or juice volume of the roots. The one generally accepted until recently is that of Scheibler using alcoholic extraction in a Soxhlet apparatus, but this, however, has certain drawbacks which are well-known. In our investigation a method based on hot aqueous extraction has been developed as a "reference" method to which all other results could be related, but the possible effects of heating on polarization are not avoided. This method is described below and is one which we regard as absolute for all practical purposes as it is practically independent of marc content and juice volume of the beet sample under test.

Principle of the method.—The major portion of the sugar in the normal weight of brei is leached out in a specially designed diffuser, the juice being collected in a 200 ml graduated flask. When the flask is nearly full the diffusion is stopped and the contents of the flask are made to 200 ml and polarized.

The exhausted brei which now contains only about 1/20th of its original sugar is transferred to a second 200 ml flask and the residual sugar is obtained by hot digestion as in the classical flask method. The sum of the two polarizations gives the polarization of the brei.

The error due to the marc volume variation is thus only 1/20th of that in the classical (single) digestion method and is, therefore, negligible. Other advantages are given below.

1. Complete absence of interference with the meniscus by pulp particles or air bubbles.
2. Complete absence of entrained air in both stages.
3. The two extractions require little attention.
4. The transfer of the exhausted brei to the flask is easy and any losses which are likely to occur will be negligible at this stage.

[1] *I.S.J.*, 1958, **60**, 102, 132.

The approximate dimensions of the diffuser and the lay-out of the apparatus are given below.

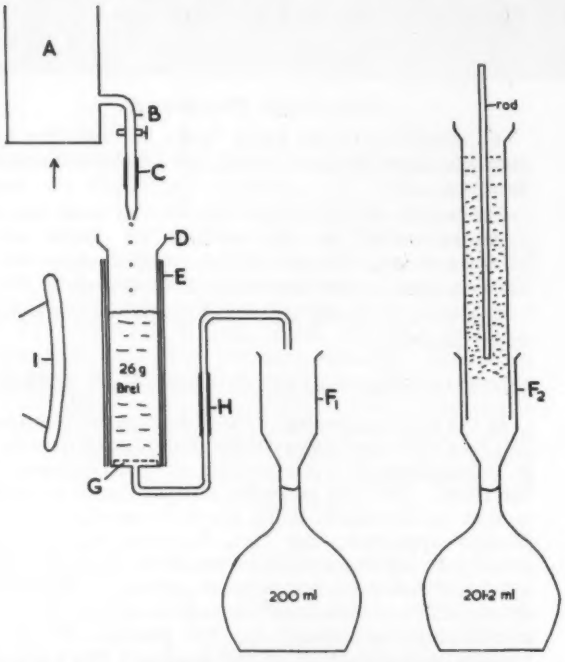

Fig 1.—Key : (A) Gas-heated boiling can of about 500 ml. capacity. (B) Soldered delivery tube. (C) P.V.C. drip sleeve with screw clip for rate adjustment. (D) Brass foil diffuser with soldered ledge at the top to assist in weighing of the brei. (E) Brass evaporator tube ; bottom piece and copper tube soldered to lower end. (14 cm × 3·0 cm dia). (F_1) 200 ml flask. (F_2) 201·2 ml flask. (G) Copper ring with soldered-on sieve top, push-fit in the bottom of the diffuser. (H) P.V.C. tube to permit adjustment of the water level in the diffuser. (I) Infra-red lamp.

Procedure.—(1) Counterpoise the clean dry inner diffuser and then weigh 26 g brei into it. (Ledge round top assists in the final adjustment of the weight).

(2) Place diffuser in jacket. (Wash any brei from the ledge of the diffuser into the body).

(3) Run dilute lead acetate from the boiler into the diffuser at full flow till it begins to overflow into the flask; then screw down the clip to a speed of about a drop a second. At this speed it should take about ½ hr to fill the flask nearly to the top. (A quicker flow reduces the extraction and lessens the error elimination).

(4) When about 190 ml have been collected stop the flow and remove the flask F_1.

(5) Cool to 20°C and make up to volume.

(6) Filter and polarize at 20°C — P_1.

(7) Raise the diffuser in the jacket and let it drain back into the jacket. When it has stopped dripping lay it on its side and take out the sieve disc from the end. Hold diffuser with lower end over a 201·2 ml Kohlrausch flask (F_2) and push the spent pulp into it with a long rod (see Fig. 1), (As only a little sugar is left in the pulp a small loss here will be negligible. It should, of course, be avoided if possible. If a 201·2 ml flask is not available, a 200 ml flask can be used and the additional 1·2 ml added from a pipette).

(8) Complete transfer with water jet. Pour contents of jacket into flask F_2.

(9) Add 1–2 ml BLA (about 55° Brix; ratio of basic lead to total lead 36%) and water to about 180 ml.

(10) Digest in a hot water bath at 80°C with occasional shaking for ½ hr.

(11) Cool to 20°C, make up to 201·2 ml mark, filter and polarize at 20°C — P_2.

(12) Calculate pol of the brei ($P_1 + P_2 = P_3$).

Calculation of the juice volume.—The juice volume in the brei sample under test can be determined thus:

Polarization by normal H.W.D. method = P

Polarization by proposed reference method = P_3

Juice Volume = V ml

Then $P \times (178{\cdot}2 + V) = 200\,P_3$

or $V + 178{\cdot}2 = \dfrac{200\,P_3}{P}$

so that $V = \dfrac{200\,P_3}{P} - 178{\cdot}2$

However, it must be pointed out that the accuracy of the result obtained depends entirely upon the accuracy with which the polarization is read. A difference of ±0·05% in polarization will cause an error of ±0·60 ml in the juice volume for normal sugar contents.

Comparative tests made over three campaigns on sawn brei by this method and the normal H.W.D. method (using 21·8 ml juice volume) on over 500 samples gave slightly higher average results of 0·06% 0·03% and 0·01%. Variations between individual tests were appreciable as would be expected due to the effect of variations in marc volumes with the standard H.W.D. method.

It is a rather tedious and time-absorbing method so that a large number of determinations could not be undertaken. Since the "reference" method depends on hot water extraction, results were compared to H.W.D. on brei and on ground up (minced) remainders of the roots after sawing so any possible effects of heating were a common factor.

The following is a summary of the results obtained covering fourteen of our factory areas during 1956/57 campaign when a total of 250 comparative tests were made:—

Sawn Brei (*A*)		M.R.s from (*A*)		Differences*	
H.W.D.	Reference	H.W.D.	Reference	H.W.D.	Reference.
16·56%	16·57%	16·53%	16·56%	·03%	·01%

The agreement between the results of the "reference" method and the normal Sachs le Dochte procedure (but using H.W.D.) on both the sawn brei and the minced remainders (M.R.s) after sawing is very close. Also in close agreement are the sugar contents of the brei obtained by sawing and the remainders (differences*) although these results are not strictly comparable in that the number of samples tested was not quite the same in the two sets of experiments.

The results do, however, establish that the normal hot water digestion method gives results which are very close to the absolute sugar content both of the sawn brei and the minced remainders. It was therefore concluded that the minced remainders could be used as a basis of comparison for all practical purposes. Standard power-driven mincing machines are used with $\frac{3}{16}$ in diameter holes in the plates and a "Parsley" type feed screw.

II. The "Macerator" Method.

The machines used in this method are also described as "homogenizers" and "blenders". The one selected as a result of our investigations is the M.S.E. "Ato-mix 100" blender with a slight modification to the mouth of the container to avoid excessive wear on the rubber gasket in the lid which caused leakage of the liquid contents while in operation. Details are given in Fig. 2.

Comparative tests were carried out throughout the 1956/57 campaign on both cossettes and on minced remainders with the following results.

(*i*) Using double normal quantities in both sets of tests (6 factories).

No. of samples tested	2359
% Sugar by H.W.D.	15·77%
% Sugar by "Atomix" (C.W.D.)	15·72%
Difference	0·05%

(*ii*) Using double normal quantities for H.W.D. and normal quantities for "Ato-mix" tests (14 factories).

No. of samples tested	4327
% Sugar by H.W.D.	15·87%
% Sugar by "Ato-mix" (C.W.D.)..	15·88%
Difference	—0·01%

The results using a normal weight in the "Atomix" machine are in much closer agreement with those obtained by the normal H.W.D. method than when the double normal weight is taken.

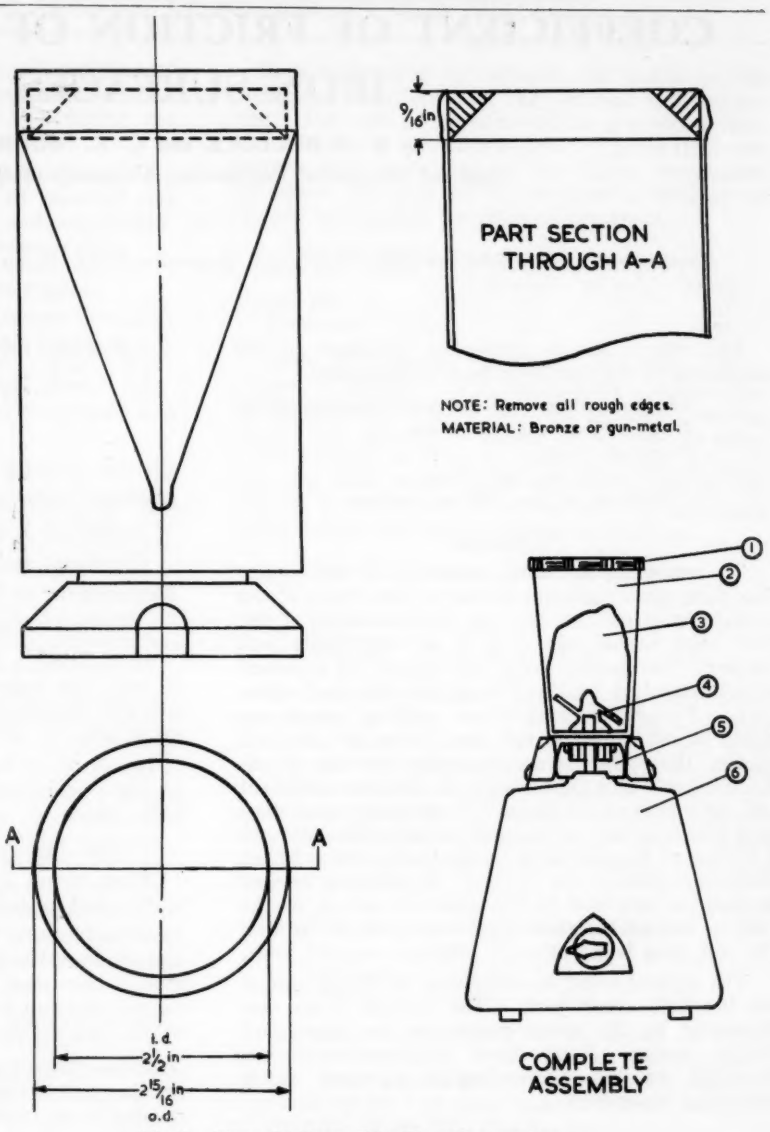

Fig 2.—Key : (1) Screw lid with rubber washer.
(2) Container made from Monel metal.
(3) 500 ml. capacity.
(4) Blending assembly.
(5) Container base fitting.
(6) Motor base as for the "Ato-Mix 800".

Tests with varying times for maceration were carried out from which it was shown that 3 minutes maceration at 12,000 r.p.m. was the optimum time. Automatic time limit switches for 3 minutes were accordingly fitted to all machines.

ACKNOWLEDGMENTS.

The author wishes to express his thanks to the Directors of British Sugar Corporation Limited for permission to publish this work.

COEFFICIENT OF FRICTION OF BAGASSE ON IRON SURFACES

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Slightly condensed from Proc. 24th Conf. Queensland Soc. Sugar Cane Tech., 1957, 81-88.

The effects of the following variables on the coefficient of friction have been investigated:—

Normal pressure of the cane on the surface.
Degree of cane preparation.
Rubbing speed.
Dryness of the cane fibre.
Condition of the rubbing surface.

Apparatus

To retain the material under test a rectangular box with open ends was bolted to the frame of the experimental mill so that the vertical sides of the box were within about $\frac{1}{16}$ in of the upper roll surface. The normal force was applied by a curved piston attached to the plunger of the feed chute jack. For experiments where rubbing speed was being investigated the roll was driven by the mill motor, the speed being controlled by the Ward-Leonard set. For experiments on limiting coefficient the chain driving the upper roll was removed and an arm was attached to the chain wheel. This allowed a torque to be applied manually to the roll until the limiting condition was reached. To obtain a smooth surface (as opposed to the grooved surface of the roll) a cold-rolled steel band was clamped around the roll, care being taken to obtain a smooth joint.

The normal force was measured by strain gauges on the feed chute jack. The friction force was measured by the strain gauges of the upper roll torque meter. Both these measurements were recorded on the Kelvin-Hughes dynamic strain recording equipment.

Method of Test

The coefficient of friction at various speeds and the limiting coefficient were investigated separately. The following values of the variables were selected:

Coefficients at Various Speeds.

Pressures: 20, 60 and 90 p.s.i.

Grooving: (*a*) smooth steel surface
(*b*) grooved cast iron surface (Meehanite grade G.C.; grooving $\frac{1}{8}$ inch pitch 34° included angle, medium machined finish in good condition).

Preparations: (*a*) fibrated
(*b*) coarse (roughly equivalent to two sets of slow speed knives).

Speeds: 10, 42 and 75 f.p.m.

Wetness: (*a*) bone dry (which will not be discussed here)
(*b*) dry (pressed to 5000 p.s.i. and then laboratory oven dried for 2 hours at 110°C)
(*c*) fresh cane.

Limiting Coefficient.

Pressures: 7, 23, 40, 55, 77 and 89 p.s.i.

Grooving: as before.

Preparation: as before.

Wetness: as (*b*) and (*c*) before.

In addition, a few tests to estimate the coefficient at very low pressures were attempted. These were not very satisfactory as the accuracy of the torque meter was not sufficiently high.

In all, about two hundred individual evaluations of the coefficient under different conditions have been made.

Real and Apparent Coefficient of Friction

These terms, when used in this paper, are to be understood as follows:—

Real Coefficient : The coefficient between the surface and the individual fibres which, it is assumed, would remain consistent for constant conditions of lubrication, pressure and rubbing speed. This coefficient would be independent of actual area of contact.

Apparent Coefficient : The coefficient calculated from the normal force applied to the bagasse and the torque applied to the roll. This coefficient varies with the actual area of contact of the fibres with the roll. It is, however, the practical or operating coefficient.

Results

The individual results are given in the Appendix. Coefficients from 0·13 to 0·66 have been recorded. From the following discussion it may be seen how the variables influence the coefficient. The results of the experiments for both the coefficient at different rubbing speeds and the limiting coefficient have been analysed statistically. The two coefficients will be discussed separately.

Coefficient at Different Rubbing Speeds.—The statistical analysis shows that the coefficient is influenced by the variables in the following order of importance: grooving; wetness; and preparation, pressure and speed.

The last three are of about equal importance. However, except for speed, it is impossible to discuss these effects individually without considering the effects they produce when acting together.

Table I shows the mean values of apparent coefficient in relation to the type of material and pressure at average values for speed and preparation. Each entry is the mean of six individual values.

Table I. Apparent Coefficients of Friction

	Smooth Surface			Grooved Surface		
	20 p.s.i.	60 p.s.i.	90p.s.i.	20 p.s.i.	60 p.s.i.	90 p.s.i.
Dry fibre	0·26	0·21	0·21	0·37	0·33	0·45
Fresh cane	0·24	0·20	0·17	0·34	0·30	0·33

(A difference as great as 0·043 in the above values would arise by chance only once in 100 such tests).

It is immediately obvious from Table I that the grooved surface gives a much higher apparent coefficient of friction than the smooth surface. For the smooth surface the coefficient of friction declines with increasing bagasse pressure, although there is very little difference throughout the six values. With the grooved surface, however, the dry fibre gives the highest coefficient with 90 p.s.i., while pressure has very little effect with fresh cane.

Closer inspection of the figures for the smooth surface shows that, in general, dry fibre gives higher coefficients than fresh cane. This is probably due to the lubricating effect of the juice in the fresh cane. This may also account, in part, for the fall in coefficient with rising pressure, as more juice will be expressed on the roll surface at higher pressures. In regard to the grooved surface, it may be seen that there is a fall in the coefficient from 20 to 60 p.s.i. and a rise from 60 to 90 p.s.i. This sudden increase is probably due to firmer packing of the fibre into the grooves as the normal force rises. This increases the apparent coefficient of friction.

Table II gives the mean values of apparent coefficient averaged over the pressure-speed combinations. It shows the unusual effects of preparation and wetness. With dry fibre the fibrated preparation gives higher values, but with fresh cane there is little difference between the coefficients for fibrated and coarse preparations. Dry fibrated fibre on the grooved roll surface gives a very high coefficient, indicating that the fibre is packed tightly into the grooves and that there is very little lubricating effect. With fibrated cane the coefficient is higher for dry fibre than for fresh cane, but with coarse preparation there is no difference between dry fibre and fresh cane. Apparently the small area of contact and easy escape of juice with the coarse preparation prevent any substantial lubricating effect.

Table II. Apparent Coefficients of Friction

	Dry Fibre		Fresh Cane	
	Fibrated	Coarse	Fibrated	Coarse
Smooth surface ..	0·25	0·21	0·19	0·21
Grooved surface..	0·43	0·33	0·32	0·33

(A difference as great as 0·03 in the above values would arise by chance only once in 100 such tests).

It is interesting to tabulate the ratios of the coefficients of friction of the grooved and smooth rolls. The ratio of the areas of the grooved surface and the smooth surface was 2·50:1. Table III shows that the drier the bagasse and the higher the pressure the nearer the ratio of the apparent coefficients of friction approaches the ratio of the areas.

Table III. Ratios of Coefficients, grooved : smooth

	20 p.s.i.	60 p.s.i.	90 p.s.i.
Dry fibre	1·43	1·57	2·15
Fresh cane	1·42	1·50	1·95

Table IV indicates the effects of speed and the wetness of the fibre. It is immediately apparent that the coefficient of friction falls with increasing rubbing speed. Dry fibre gives higher values, but the effect is less marked at 10 f.p.m. than at 42 and 75 f.p.m. The dry fibre packs more thoroughly against the surface as the speed increases, but the increasing speed reduces the real coefficient of friction.

Table IV. Apparent Coefficients of Friction

	Dry fibre	Fresh cane
10 f.p.m.	0·33	0·32
42 f.p.m.	0·31	0·25
75 f.p.m.	0·28	0·22

The combined effects of pressure and preparation are shown in Table V. The coefficient falls with increasing pressure from 20 to 60 p.s.i. and then rises from 60 to 90 p.s.i., but this rise in coefficient is very small with coarse preparation. This may again be explained by the fact that the real coefficient falls with pressure, but the contact area becomes greater with increasing pressure, especially for the fibrated preparation.

Table V. Apparent Coefficients of Friction

	20 p.s.i.	60 p.s.i.	90 p.s.i.
Fibrated	0·37	0·29	0·33
Coarse	0·31	0·28	0·29

The pressure-grooving effect as shown in Table VI is very interesting. It may be seen that the ratios of the coefficients increase linearly with pressure approaching the area ratio limit of 2·50 as discussed previously. When this straight line is extrapolated towards zero pressure a ratio of 1·3 at no pressure is indicated. It is felt that this ratio is a measure of the difference between the cold-rolled steel of the smooth surface and the machined cast iron of the grooved surface. Other experiments at low pressures have also indicated that grooving has very little effect at lower pressures. This arises from the fact that the area of actual contact is small and approximately constant for any surface at low bagasse pressures.

Table VI. Apparent Coefficients of Friction

	20 p.s.i.	60 p.s.i.	90 p.s.i.
Smooth	0·27	0·21	0·20
Grooved	0·41	0·36	0·42
Grooved / Smooth	1·52	1·71	2·10

Limiting Coefficient.—Values of the limiting coefficient of friction for fresh cane are shown graphically

in Fig. 1. It is seen that at low pressures the coefficient is about the same for both grooved and smooth surfaces and has a mean value of about 0·45. With the grooved surface the coefficient rises with pressure as packing into the grooves increases and the actual area of contact becomes greater. The smooth surface exhibits the natural falling characteristics of the real coefficient of friction.

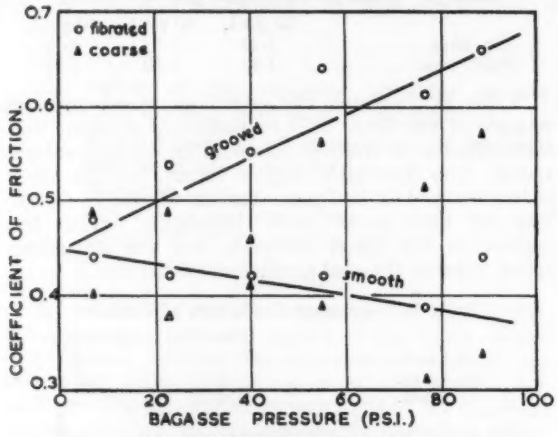


Fig. 1—Limiting friction—fresh cane.

The behaviour of the limiting coefficient with dry fibre appears to be extremely complex. The values are plotted in Fig. 2. This shows that fibrated preparation gives a much higher coefficient than coarse preparation. Also, in general, the grooved surface gives higher values than the smooth.

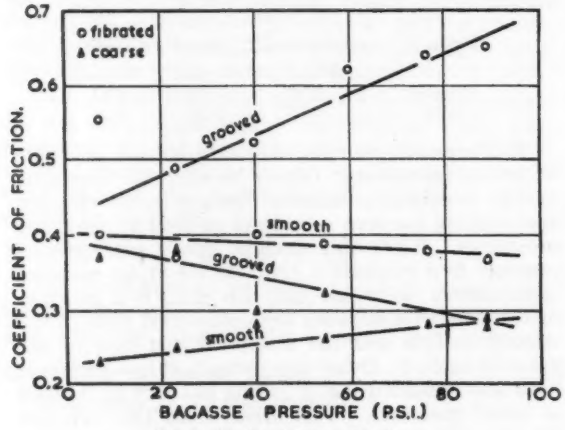


Fig. 2—Limiting friction—dry fibre.

Conclusions

The coefficient of friction of bagasse on the iron surfaces investigated varies widely under different conditions. An attempt to summarize this variation may be made as follows:—

Speed. The coefficient of friction decreases with increasing rubbing speed, but the decrease is less rapid with dry fibre than with fresh cane.

Preparation. Fibrated preparation gives higher coefficients than coarse preparation, but

(*i*) at higher pressures the difference is less marked;

(*ii*) with fresh cane the difference is less marked than with dry fibre.

Grooving. The grooved surface gives higher apparent coefficients of friction than the smooth surface, but

(*i*) the difference is more marked at higher pressures and the ratio of grooved to non-grooved coefficients approaches, in the limit, the ratio of the areas of the surfaces (2·50);

(*ii*) the difference is more marked with dry fibre than with fresh cane;

(*iii*) the difference is less marked with coarse preparation.

Wetness. Dry fibre gives higher coefficients of friction than fresh cane, but

(*i*) the difference is less marked at low speeds;

(*ii*) the difference is less marked with coarse preparation;

(*iii*) the difference is less marked on the smooth surface;

(*iv*) the difference is more marked at high pressures.

Pressure. The real coefficient decreases with increasing pressure; but, due to the packing against the surface, the apparent coefficient is higher at higher pressures than at lower pressures.

The limiting coefficient is, in general, higher than the coefficient between surfaces in relative motion, as is usually the case in friction investigations.

APPENDIX

Coefficients of Friction under various conditions

Speed r.p.m.	Smooth Surface				Grooved Surface			
	Dry Fibre		*Fresh Cane*		*Dry Fibre*		*Fresh Cane*	
	Fibrated	Coarse	Fibrated	Coarse	Fibrated	Coarse	Fibrated	Coarse
	Pressure 20 p.s.i.							
10 ..	0·31	0·31	0·31	0·34	0·49	0·32	0·41	0·42
42 ..	0·24	0·27	0·22	0·20	0·45	0·28	0·34	0·30
75 ..	0·24	0·21	0·21	0·18	0·40	0·30	0·28	0·28
	Pressure 60 p.s.i.							
10 ..	0·25	0·22	0·20	0·29	0·35	0·29	0·34	0·33
42 ..	0·22	0·19	0·17	0·22	0·36	0·33	0·31	0·30
75 ..	0·21	0·19	0·13	0·17	0·35	0·30	0·25	0·28
	Pressure 90 p.s.i.							
10 ..	0·25	0·19	0·19	0·22	0·52	0·43	0·36	0·40
42 ..	0·28	0·18	0·18	0·15	0·50	0·41	0·32	0·33
75 ..	0·21	0·15	0·13	0·13	0·48	0·33	0·31	0·29

Limiting Coefficient of Friction

Pressure p.s.i.	Smooth Surface				Grooved Surface			
	Dry Fibre		*Fresh Cane*		*Dry Fibre*		*Fresh Cane*	
	Coarse	Fibrated	Coarse	Fibrated	Coarse	Fibrated	Coarse	Fibrated
8 ..	0·23	0·40	0·49	0·44	0·37	0·55	0·40	0·43
23 ..	0·25	0·37	0·38	0·42	0·38	0·49	0·49	0·53
40 ..	0·28	0·40	0·41	0·42	0·30	0·52	0·46	0·55
55 ..	0·26	0·39	0·39	0·42	0·32	0·62	0·56	0·64
77 ..	0·28	0·38	0·31	0·39	0·28	0·64	0·51	0·61
89 ..	0·28	0·37	0·34	0·44	0·29	0·65	0·57	0·65

THE MODE OF PERIODATE ATTACK ON THE DIALYSED BROWNING PRODUCTS FROM CANE FINAL MOLASSES

By W. W. BINKLEY (New York Sugar Trade Laboratory, Inc.).

DIALYSIS possesses some unique advantages as a method for the isolation from cane final molasses of its sugar polymers, particularly the melanoidins or "browning" products. The separation of the "browning" reactants, amino acids and reducing sugars, and their less complex intermediate products along with other simple water-soluble molasses constituents is achieved in simple equipment at temperatures (5-30°C), which markedly retard continued polymerization. The empirical formula of the repeating unit in these "browning" polymers, $C_{17-18}H_{26-27}O_{10}N$, has been deduced from their elemental analysis[1]. The component parts of this unit appeared to be two hexose residues and an amino acid residue with an average number of five carbons. Hydrogenolysis experiments revealed that a significant fraction of those hexose residues had retained their fundamental structure[2]. Rate studies of the action of the glycol-splitting reagent sodium metaperiodate on the molasses "browning" polymer indicated that both primary and secondary reactions were involved[1]. The nature of the attack of this reagent on the polymer could provide important clues to its structure. The significant results of our investigation along these lines are herein reported.

Inulin was used as a reference material in our present studies. Although the hydrogenolysis of this polysaccharide is mentioned in the patent literature[3], details are lacking. We have depolymerized inulin by this process and these particulars are included also.

Experimental

Preparation of the Periodate Oxidized "Browning" Polymer

One gram of molasses polymer in 50 ml of water was admixed thoroughly with 150 ml of 0·05 *M* sodium metaperiodate and the resulting solution was adjusted with water to 500 ml. The duration of the reaction at 24-26°C for the different preparations was 1, 7, 18, 24 hr and 11 days and the periodate consumption during these periods was 3·9, 5·8, 6·5, 6·7 and 10·9 millimoles of oxidant per g polymer, respectively. These oxidations were stopped by the addition of 1·8–2·0 g of diacetyl to each of the reaction mixtures. The periodate oxidized polymers were isolated by dialysis in a cellulosic membrane bag (26 in long, 2·25 in dia., 0·0023 in wall thickness) for 96 to 108 hr against deionized water in apparatus which permitted the complete change every 2 hr of the solution outside the membrane bag and by dewatering partially by reduced pressure evaporation at 50°C and freeze-drying, with yields of 0·75, 0·65, 0·63, 0·62 and 0·44 g, respectively.

Hydrogenolysis of the Periodate Oxidized "Browning" Polymer.

The oxidized polymer (0·5–0·6 g) in 200 ml of distilled water and 5–6 g of Raney nickel were subjected to hydrogen at 130–140 atm and 100–105°C for 4 hr and then at 160–180 atm and 165–170°C for 6–8 hr. The nickel was removed from the cooled reaction mixture by centrifugation. The non-volatile reaction products were isolated by solvent removal at 60°C under reduced pressure, yield 0·25–0·35 g; they were nearly colourless syrups. They were obtained without colour by allowing the previously centrifuged solution to pass through a bed of mixed anion- and cation-exchange resins before solvent removal.

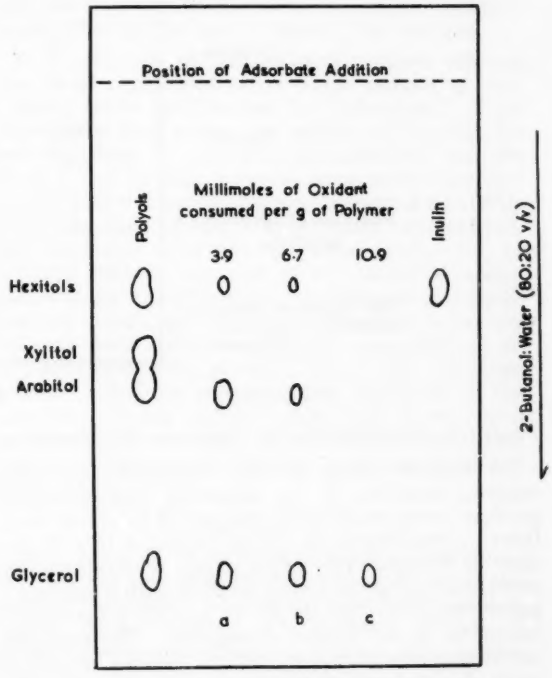


Fig. 1.

Hydrogenolysis of Inulin

A clear hydrosol was prepared by heating 2·0 g of inulin in 200 ml of distilled water to about 60°C. This sol admixed with 5–6 g of Raney nickel was subjected to 180 atm of hydrogen for 7 hr at 160–170°C. The nickel was removed by centrifugation and ion exchange resins. A colourless syrup was obtained after solvent removal under reduced pressure at 60°C, yield 1·7 g.

[1] BINKLEY: *I.S.J.*, 1957, **59**, 178.
[2] BINKLEY: *I.S.J.*, 1957, **59**, 64.
[3] Dutch Patent 65,118 (January 16, 1950); *Chem Abstr.*, 1950, **44**, 6180i.

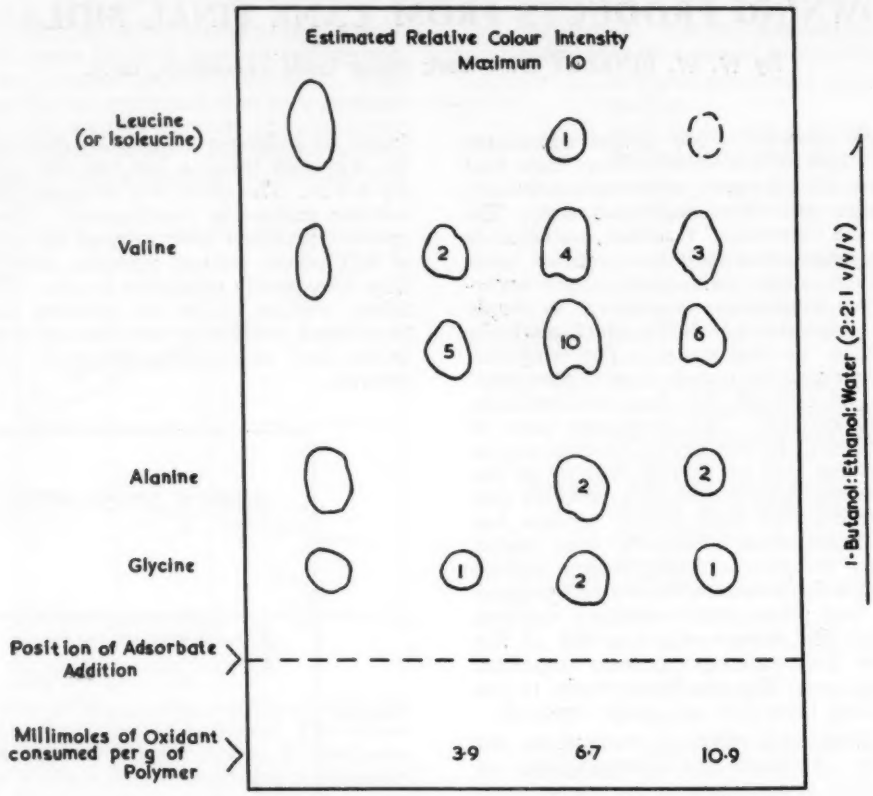


Fig. 2.

Paper Chromatography of the Hydrogenolysis Products.

(a) *Polyols*[4].—Two to four additions of a 5% aqueous solution of the deionized hydrogenolysis products were made at the designated locations 8 cm from and parallel to the shorter edge of a 14 × 53 cm sheet of Whatman No. 1 filter paper. This descending papergram was developed at 20–22°C with 2–butanol : water (80:20 v/v) for 48 hr for general polyol resolution, 92 hr for hexitol separations. The resulting chromatograms were dried in air at 24–26°C and were sprayed with sodium metaperiodate-potassium permanganate reagent[5].

The essential features of these chromatograms are presented in Fig. 1.

(b) *Amino-acids.*—One or two additions of a 5% aqueous solution of the hydrogenolysis products (before deionization) were made at the proper place on a 28 cm square of Whatman No. 1 filter paper. This ascending chromatogram was developed at 20–22°C with 1-butanol:ethanol:water (2:2:1 v/v/v). The amino acids were detected with ninhydrin reagent. This chromatogram is shown in Fig. 2.

Four additions of a 5% aqueous solution of the hydrogenolysis products from the oxidized polymer (24 hr reaction) were made at the proper place on an 18 cm square of Whatman No 1 filter paper. This chromatogram was developed at 20–22°C first with phenol:water (80:20 w/w), dried in air at 25°C for

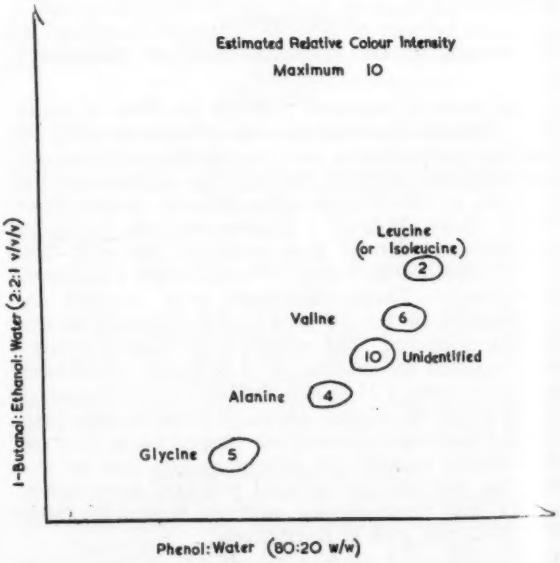


Fig. 3

16–18 hr, turned through 90° and developed at 20–22°C this time with 1–butanol:ethanol:water

[4] SMULLIN *et al.*: *Abstr. Papers Amer. Chem. Soc.*, 1957, **131**, 10D.
[5] LEMIEUX and BAUER : *Anal. Chem.*, 1954, **26**, 920.

(2:2:1 v/v/v). The chromatogram was dried again in air at 25°C and sprayed with ninhydrin ; it is depicted in Fig 3. All identifications were verified by spot enhancement with authentic substances.

Results and Discussion.

Three-, five- and six-carbon polyols were detected in the hydrogenolysis products from the periodate oxidized molasses "browning" polymer (Fig. 1). They represented in these oxidized melanoidins the units which possessed the corresponding number of carbons and could be converted readily to these polyols. The periodate attack proceeded in two distinct phases[1]. The first phase was characterized by the utilization of 6·5–6·7 millimoles of oxidant per g of polymer in 24 hr, the second phase by the consumption of 4·2 millimoles of reagent during the following 10 days. The formation of five-carbon units occurred during the first phase of the oxidation. These were numerous when the consumption of oxidant had reached 3·9 millimoles per g of polymer and they had decreased significantly in quantity at the end of the first stage of the reaction (compare the arabitol spots in Fig. 1*a* and *b*). Nearly all of the hexose residues had been altered at this point (compare the hexitol spots in Fig. 1*a* and *b*). The five- and six-carbon units readily converted to their corresponding polyols were not present in the polymer after the utilization of 10·9 millimoles of periodate per g. The three-carbon residues were produced during the rapid initial consumption of oxidant and underwent little apparent change in amount throughout the remainder of the reaction period (compare the glycerol spots in Fig. 1*a*, *b* and *c*). The hydrogenolysis of inulin under conditions identical to those used for the oxidized polymer produced hexitols only. The presence of three- and five-carbon polyols in the reaction products was attributable to the oxidized polymer and not to the method of depolymerization.

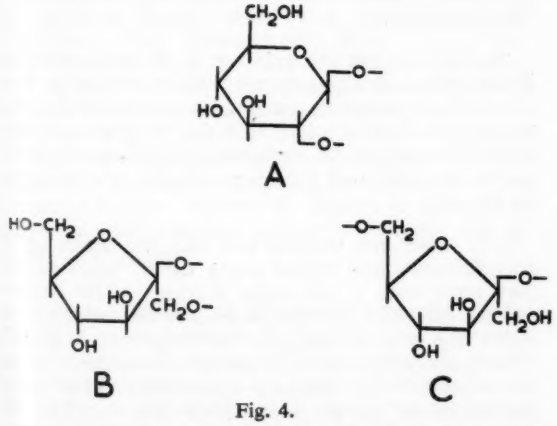


Fig. 4.

The three-carbon residues in the oxidized polymer are normal products from the splitting of a glycol arrangement located at C-3 and C-4 of a hexose unit in which the hydroxyl or other functional group at C-2 and C-5 are unable to participate in the reaction. This situation does exist in the (1→2) pyranose and (2→1) and (2→6) furanose structures (Formulae A, B and C, respectively, of Fig 4). The presence of arabitol among the hydrogenolysis products is significant. Scission with periodate of the bond between C-1 and C-2 of the glucose and fructose structures is indicated. This is not an uncommon type of oxidative attack. Hydrogen peroxide with the proper iron salt[6], buffered aqueous chlorine[7] and ionizing radiation in air[8] can cleave at this point either glucose or a suitable derivative. The production of formaldehyde during the periodate-polymer reaction was noted previously[1]. The primary alcohol group at C-1 of the fructo-furanose structure (Formula C) would be a logical source of this aldehyde. In addition to these attacks at specific points, the oxidant engaged in polymer destruction. This observation was based on the 29·0% loss in the yield of oxidized polymer during the last 10 days of the reaction.

Hydrogenolysis of the molasses polymer released four of its component amino acids, namely glycine, alanine, valine and leucine (or isoleucine)[2]. These were found also among the products from the depolymerization of the periodate-oxidized polymer (Figs. 2 and 3). The principal nitrogen-bearing substances in this instance however, possessed a mobility slightly less than valine and as yet remains unidentified. The concentration of this compound appeared to be 2–3 fold that of any one of the identified amino acids (Fig. 2). The presence of this unknown ninhydrin-sensitive material(s) was not observed in either the molasses from which the polymer was isolated[9] or the hydrogenolysis products from the molasses polymer[2]. Sodium metaperiodate produced in the molasses polymer residual structures from which hydrogenolysis released a non-volatile, nitrogen-bearing substance(s) in addition to the four identified amino acids.

Summary.

Three types of oxidative attack were observed in the reaction of sodium metaperiodate with the dialysed "browning" products of cane final molasses, namely, glycol splitting, C1–C2 bond scission of hexose residues and general oxidation. The specific bond cleavages were the principal primary reactions of the oxidation ; the secondary reactions caused general polymer destruction. The periodate-oxidized polymer possessed residual structures which upon hydrogenolysis yielded a nitrogen-bearing substance(s) in addition to the four identified amino acids, glycine, alanine, valine and leucine (or isoleucine).

Acknowledgment.

The writer wishes to thank Mr. G. H. Neff of the Department of Chemistry of The Pennsylvania State University for his assistance in the hydrogenolysis

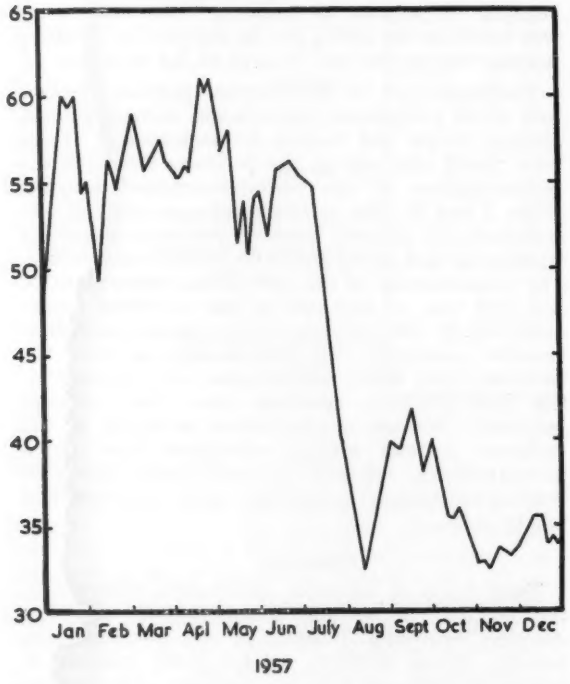
[6] Ruff : *Ber.*, 1898, **31**, 1573 ; 1901, **34**, 1362 ; Fenton and Jackson : *J. Chem. Soc.*, 1899, **75**, 1.
[7] Henderson : *J. Amer. Chem. Soc.*, 1957, **79**, 5304.
[8] Wolfrom *et al.*: *Abstr. Papers Amer. Chem. Soc.*, 1956, **130**, 16A.
[9] Kowkabany *et al.*: *J. Agric. Food Chem.*, 1953, **1**, 84.

THE SUGAR TERMINAL MARKET IN LONDON

THE year 1957 saw tremendous movements in sugar prices. This needs no emphasizing to those in the sugar trade and sugar using industries but, nevertheless, the point is illustrated in the accompanying graph. Hardly a week in fact passed without fluctuations and at times prices move by several pounds per ton in a single day.

LONDON DAILY RAW SUGAR PRICES

Shillings per cwt c.i.f. U.K.



The problem of how to take advantage of market movements and at the same time to avoid stock losses in periods of such uncertainty must have exercised the minds of many in the sugar-industry during the past year and it is felt that it may be timely to draw the attention of the industry to the facilities available in the London Terminal Market where, during the first year after its post-war reopening the execution of orders from a substantial cross-section of both producers and consumers in the world trade resulted in a turnover representing over 700,000 tons of sugar.

There are those who feel that for the time being sugar has had its fling and that we are unlikely to encounter such violent price fluctuations in the foreseeable future. This may be so, but it is in itself a speculative view, and it is precisely to avoid the need for speculation and not, as is the popular view, to encourage it, that the Terminal Market exists.

The fundamental service provided by the Terminal Market is to ensure a continuous and highly sensitive indication of sugar values for delivery well into the future. Through the market it is always possible to ascertain the value for any delivery month up to a year ahead knowing that this reflects the combined judgment of traders in many different spheres throughout the world. Refiners, dealers and manufacturers in the United Kingdom, Commonwealth producers and shippers, Cuban shippers in New York, beet producers on the Continent, merchants in sugar from Cyprus to Singapore, and last but not least the ubiquitous speculator whose presence oils the wheels of any market and aids the smooth and orderly movement of prices—all are currently using the market for their own particular purposes.

In addition to providing a sensitive index of sugar values, the market is designed for ease of trading. Terminal business is transacted without formality on a standard contract, commission rates are low (about 3d per cwt or well under 1% at current values for a complete transaction i.e. a purchase and a sale) and margin requirements are modest.

There are, of course, many ways in which a sugar user can benefit from judicious use of the Terminal Market and no two cases will be exactly alike. Basically, however, the market is used :—

(a) *To protect stocks.* Manufacturers forced to carry stocks of sugar can fix their value and protect themselves from severe stock losses by selling on the Terminal Market.

(b) *To establish the price on a forward purchase.* Where physical sugar is not readily available it is often of advantage to a manufacturer to buy futures, exchanging them at a later date for the precise quality of physical sugar he requires. This is particularly useful when forward futures prices are at a discount on "spot".

It is sometimes pointed out that the majority of manufacturers are refined sugar users ; what would they want with a raw sugar market ? The answer to this, of course, is that nowadays all sugar prices follow the raw market and "raw sugar c.i.f. U.K." is the basic yardstick. A study of price relationships will confirm that refiners consistently base their quotations on the price at which they can buy replacement raw sugar. Movements in the refining margins are not unknown but they are invariably very small and involve a minute relative risk compared with the absolute one of a major swing in sugar prices.

Preparation of Seed Slurry. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1956, **5**, 11–13.—Preparation of the most fine and regular seed slurry was by concentrating a sugar solution to 77°Bx at 110–120°C and cooling rapidly to 0°C. Since cooling rapidly to 0°C is difficult in practice, a regular and fine-grain slurry can be obtained by concentrating to 81–82°Bx and cooling to 30°C in about 15 min with slow stirring below 70°C to prevent formation of a crust of crystals, followed by ½–1 hr of further agitation at 30°C. The slurry kept in good condition for 24 hr if the container was covered with a wet cloth.

* * *

Factory Results obtained by Ion Exchange Resin in combination with Carbonatation. S. AKIMOTO. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1956, **5**, 14–18.—Adoption of the use of ion exchange resins combined with carbonatation[1] reduced costs by $3·61 per ton on a melt of 400 tons per day, by elimination of active carbon. The colour of liquors was reduced so that white sugar recovery increased from 82% to about 90%. The sulphated ash content of hard sugar was 30% lower and further benefits were scale-free boiling, fuel economy and undiminished sugar yield. Final decolorization of fine liquor is with three towers of "Amberlite IRA-401", each containing 5000 litres of resin and treating more than 180 tons a day.

* * *

Application of the Electromagnetic Slip Coupling to the Agitation Speed Control of a Crystallizer. K. KINOSHITA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1956, **5**, 19–22.—The torque characteristics of the "Vari-Slip" electromagnetic slip coupling were such as to enable its successful application to the drive of a 20-ton crystallizer. The coupling is of 5 h.p. capacity, speed being controllable within the range 1050 to 1500 r.p.m., and the highest exciting current is 3 amp. Automatic control so achieved is simple and safe; remote control is possible, and no clutch is required.

* * *

Decolorizing Effects of Pittsburgh Granular Active Carbon in Sugar Refining. J. SHIMIZU. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1956, **5**, 34–43. Laboratory experiments are reported on the use of Pittsburgh Coke & Chemical Co. granular active carbon type C.A.L. (P.G.A.C.) in place of active carbon in the carbonatation-active carbon-anion exchange resin process. The P.G.A.C. was mixed with 5% of burnt magnesite by weight so almost eliminating pH drop during treatment. Liquor temperature was 70 ± 5°C. Brown liquor of Lovibond colour 4·4–14° was decolorized to 0·27–1·2°, decolorization dropping from 97% to 73% on passage of 125 parts of sugar per part of carbon by weight. Third molasses, diluted to 57–62°Bx, of 4·1–11·6° Lovibond were decolorized to 0·71–3·33° on passage of 91 parts of sugar per part of carbon. Optimum temperature was 60–70°C and contact time 1½–2 hr. Purification cost using carbonatation—P.G.A.C.—ion exchanger is calculated to be $111 per 100 tons melt, compared with $142 with P.G.A.C. alone and $160 for the bone char process.

* * *

Preheater Automation Calculations. M. I. KULIK. *Sakhar. Prom.*, 1957, (7), 31–33.—Formulae and tables are given which are necessary for arranging automatic control of steam supply to preheaters. It is pointed out that the precise formulae are only necessary for pre-heaters with non-standard piping when they are near the evaporators, for normal preheaters far removed from the evaporators, or when the cross-section of the steam feed line to the preheaters does not correspond to the given steam flow rate. If the pressure drop in the steam line (including local resistances) is equivalent to a temperature drop of no more than 2°, the only tables needed are those showing pressure drop for temperatures from 60 to 150° at the start of the regulated region, and maximum temperature of the heating steam in the heat chamber.

* * *

Acid Resistant Storehouse for Hydrochloric Acid. I. KLOCHKO. *Sakhar. Prom.*, 1957, (7), 34–36.—Details are given of a 30·6 cu.m. storehouse, the concrete walls and floor of which are faced with a diabasic acid-resistant cement manufactured from powdered stone, sodium fluosilicate, and water-glass.

* * *

New Techniques and Trends in Sugar Operations in Cuba. J. C. TARAFA. *Sugar J.* (La.), 1957, **20**, (3), 22–23, 27, 30–31.—The changes which have taken place in recent years and trends indicated are reviewed. These include conversion from rail haulage of cane to transport in road trucks ; installation of a second set of knives; running Corliss engines at high speed with replacement by turbines when necessary ; use of centralized lubrication, addition of extra (second-hand) boiler capacity ; electrification of prime movers except for mill drive ; increasing juice heater capacity ; use of automatic pH and temperature control in the clarifiers ; redesigning of evaporators and condensers ;

[1] *I.S.J.*, 1957, **59**, 130.

improvement of vacuum pans, with mechanical circulation for the low-grades and hydraulic operation of valves, as well as automatic controls for boiling ; installation of cooling coils in crystallizers, and gradual replacement of centrifugals with modern automatic machines.

* * *

New Sugar Boiling Process. ANON. *Sugar J.* (La.), 1957, **20,** (3), 31.—A two-boiling sytem is described in which first massecuite is discharged to rapid-cooling crystallizers where the molasses purity is lowered to slightly below the final massecuite purity. The final massecuite is produced by full seeding and after curing is used as footing for the first massecuite.

* * *

Instrumentation in Cuban Sugar Mills. G. E. OCHOA. *Sugar J.* (La.), 1957, **20,** (3), 40–41.—Instruments which have been installed in various mills are mentioned, with a review of those which may be adopted in the future.

* * *

Modernizing a Cuban Sugar Mill. M. A. FALLA A. *Sugar J.* (La.), 1957, **20,** (3), 43, 45–46, 48–49.—The improvements carried out between 1946 and 1956 are described briefly, and the effects of these, up to 1955, illustrated by a table of manufacturing data for 1946 and 1955.

* * *

Ash Reduction in Refined Sugars. J. M. LÓPEZ-OÑA. *Sugar J.* (La.), 1957, **20,** (3), 53, 55–56, 58.—Reduction of ash in refinery product from 0·035–0·05% to 0·007% was achieved by using active carbon instead of carbon plus a bleaching agent, and replacement of part of the lime used with caustic soda. A similar system might be applied to raw sugar production when, besides a better product, another advantage would be reduced scale formation.

* * *

Automatic Pan Operation at Central Soledad. J. A. CLARK and A. A. CHISHOLM. *Sugar J.* (La.), 1957, **20,** (3), 60–61, 63–64.—Control instruments installed at Soledad include a Holven-type supersaturation recorder and control ; absolute pressure control ; and a consistency control which measures the torque necessary to turn three small propellers in the massecuite. When operating, the purity dial is set for the purity of the boiling sugar solution and evaporation continued under controlled vacuum (26 ± 0·1 in Hg) until supersaturation 1·3 when seed fondant is introduced. On reaching supersaturation of 1·4, the vacuum is reduced to 24 in Hg and feed provided in drinks until the crystal surface area is sufficient to permit continuous feeding. This takes place under the consistency control until the pan is full, when the feed valve is shut and the massecuite heavied-up. Advantages of the technique include reproducibility, better sugar quality and size control, faster and easier boiling and purging ; and more complete molasses exhaustion.

Diffusion of Sugar from Shredded Cane. S. L. PLANSALKER and K. H. RAO. *Sugar y Azúcar*, 1957, **52,** (8), 25.—After 5 minutes immersion in an unstated amount of water at an unstated temperature, 95–98% of the sucrose content of laboratory-shredded cane was extracted.

* * *

The Effect of Reducing Sugar Content and Relative Humidity on the Storage of Soft Sugar Products. S. HONDA and Y. KAMEI. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1956, **5,** 1–6.—Investigations of caking, etc. were made using atmospheres of constant humidity, on sugar samples of varying reducing sugars content in different packing materials. More caking occurred at lower humidity; polyethylene was excellent for water-proofing and better than paper or cotton bags ; 50 hr at 25°C were sufficient to bring a 10-g sample to equilibrium moisture for a relative humidity below 75% ; for white sugar of 0·03% ash reducing sugar content was proportional to equilibrium moisture ; the equilibrium relative humidity of soft white medium sugar (1·9% R.S., 1·7% moisture, 0·2% ash) was 75% at 25°C, and 85% for soft white superior sugar (0·1 R.S., 1·7% moisture, 0·03% ash); R.H. and equilibrium moisture were in linear proportion up to 70% R.H.—moisture content increased rapidly up to and beyond 75% R.H. Cementation and hygrosopicity can be prevented by using a waterproof packing ; it is better to control the R.H. in the store as near as possible to the E.R.H., and it will be possible to store soft sugars successfully provided their reducing sugar and moisture content are properly controlled.

* * *

Experiments with the Schumacher Ceramic Filter. M. AKINO, T. TANAKA and K. NAKAZATO. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1956, **5,** 7–10.—A test filter plant included four Schumacher ceramic tube filters, each 120 mm dia., 250 mm long and 25 mm thick. Using the ICUMSA formula devised for filtrability of kieselghur and active carbon, the resistance value of an uncoated cell was found to be about ¼ of that of a cell coated with 1 kg/sq.m. of filter-aid using syrups of 64–65°Bx at 65–68°C. Advantages of the ceramic filter are the easy removal of cake by back-washing ; impossibility of cake leakage ; and stability or the filter under fluctuating pressure so that the precoat and cake do not slip during filtration.

* * *

Milling Studies—1. Influence of Roller Speed on No. 1 Mill Performance. *Technical Report.* (Sugar Research Institute, Queensland), 1957, (37).—Provided the correct relationship is selected between crushing rate, roll speed and mill setting, roll speeds considerably in excess of those generally used in Queensland are not detrimental to extraction at No. 1 mill. When two of the above factors are pre-selected, the third becomes automatically determined. Extraction is very largely a function of Compression Ratio. The practical range for C.R. appears to be

1·4 to 1·6 at the feed roll, yielding a juice extraction of 40–55%. A work ratio of 2 : 1 then gives an overall C.R. of 2·8 to 3·2, yielding extractions of 70–75%, with the experimental mill. There were indications that thick feed blankets at low speeds yield lower overall extractions than thin blankets at higher speeds, probably due to a reduction in reabsorption at the feed roll, brought about by improved drainage.

* * *

Milling Studies—2. Influence of Cane Preparation on No. 1 Mill Extraction. *Technical Report.* (Sugar Research Institute, Queensland), 1957, (38).—Preliminary tests with the experimental mill showed a marked difference in mill performance, depending on the degree of preparation of the feed; in one series, the preparation was (a) equivalent to rather poor double-knifing, in the other the feed resembled (b) knifed and Searby-shredded cane. With identical mill settings and roll speeds, the average extraction for (b) was about 2 units better than for (a) ; this was attributable to a reduction in juice reabsorption at the feed roll. The power input when crushing (b) was also as much as 17% less than for (a). To obtain the increased extraction from knifed cane to bring it to the level obtained with shredded cane would require a higher compression ratio, demanding an increased power input of about 23%.

* * *

Milling Studies—3. Power Requirements in the Experimental Mill. *Technical Report.* (Sugar Research Institute, Queensland), 1957, (39).— It was found that it is not good practice to effect *large* increase in crushing rate simply by increasing roll speeds and keeping openings constant ; this not only gives lower extraction rate but also a significant increase in power consumption. If the desired increase in rate cannot be obtained at a given roll speed without causing the feed C.R. to fall below 1·4 : 1 while keeping the mill ratio not higher that 2·2:1, increase in roll speed is desirable. As a guide, it can be said that the speed should be such that at the required rate, reasonable extraction should be obtained at a mill ratio no greater than 2:1. Higher extractions at any roll speed require considerably more power ; but with appropriate attention to mill operation, the power increase for commercial units may not be so great as for the experimental mill.

* * *

Milling Studies—4. Mill Ratio and No. 1 Mill Performance. *Technical Report.* (Sugar Research Institute, Queensland), 1957, (40).—The work ratio of the experimental mill was varied over a range of 1·46 to 3·04, by keeping the feed opening constant and varying the delivery opening, at a roll peripheral speed of 14·6 ft/min. The simple expedient of closing the delivery opening sets in train a series of events which greatly complicates the performance of the mill. As the ratio is increased beyond 2·0, the feed roll extraction increases at constant feed roll escribed volume. While there is some evidence that this increased juice flow may arise from the increased C.R. at the delivery squeeze, the possibility of partial feed roller slip seems to have more indirect support from the experimental results obtained. If this be the case, then in practice this method of improving extraction is not to be advocated as it leads to a reduction in crushing rate and promotes roll polishing. A point is reached eventually where, in attempting to maintain crushing rate, mill choking will occur. Ratios in excess of 2·0 : 1 seem unnecessary if roll speed, crushing rate and feed roll setting are kept in correct relationship. If the C.R. at the feed roll is unduly low, then high mill ratio is necessary to obtain satisfactory extraction. Wide feed openings in relation to crushing rate indicate poor feeding ability of the mill.

* * *

Milling Studies—5. Reabsorption of Juice in a No. 1 Mill. *Technical Report* (Sugar Research Institute, Queensland), 1957, (41).—The question is treated both from the theoretical viewpoint and from the results of investigations. Reabsorption can occur only if the point of maximum pressure between the rolls is in front of the point of closest approach. No simple explanation is offered, but a theory is presented which relates the phenomenon partly to extrusion of the blanket and partly to free flow of the juice relative to the blanket through the delivery opening. EGETER's hypothesis is therefore partially correct. Experimental results show a straight line relationship between reabsorption and compression ratio; it is always greater for the same C.R. at higher roll speed. No evidence was found for a sudden increase in the reabsorption factor as found by EGETER, thus resulting in an optimum setting for the mill. However, the finding of EGETER related to the final mill of the train. The factor is also less with more finely prepared cane, due to the lower pressure required to express the juice. The time factor involved in developing the maximum pressure seems to be the most important single factor affecting the onset of reabsorption; hence the influence is reduced by increased roll diameter. In the tests range, however, as C.R. increased the extraction also increased, despite a greater loss due to reabsorption.

* * *

Relationship between Cane Composition and Composition of First Expressed Juice. *Technical Report* (Sugar Research Institute, Queensland), 1957, (42).—While relationship between brix and pol of first expressed juice and absolute juice is controlled by the structure of rind, pith and node of the cane, it is affected by proportion of extraneous matter. The relationship may vary from year to year and according to region, variety and state of maturity. In all localities in Queensland, the correction factors are greater than those allowed for by the C.C.S. formula. Results from the experimental mill to date do not show any marked influence of front roll extraction on the relationship, while degree of preparation of the feed also had little effect.

BEET FACTORY NOTES

Drying Plants in the Sugar Industry. A. SCHWIETER. *Zeitsch. Zuckerind.*, 1957, **82**, 209-216.—The development of the beet pulp dryer, and especially of the Büttner drum dryer, is reviewed. Attention to the saturation point of boiler waste flue gases used in the dryers and so to corrosion, is emphasized. The various types of furnaces and grates are discussed. White sugar dryers and coolers are also reviewed, as are beet leaf and press mud dryers. One most important aspect of the drying phase is de-dusting, and descriptions are given of various dust separators. The reader is referred to tables and data given in the "Zuckertechnikertaschenbuch".[1]

* * *

Heat Economy of Drum Drying. W. WERNER. *Zucker*, 1957, **10**, 295–298.—The influence of the firing method, treatment, and amount of the flue gases on the heat economy of a 2·8 m drum pulp dryer is discussed. Under certain conditions a relationship has been established between the intake temperature and the discharge temperature, whereby the former increases as the latter decreases. Good heat economy can be obtained by effecting intake of all the air for combustion via the travelling grate with simultaneous air-sealing of the whole drying unit. In this way the furnace temperature is kept low and allows maximum efficiency. For such conditions it is necessary to have an adequate travelling grate of maximum possible length. Only where coal is used can the specifications be disregarded, as the waste gases are then not completely combustible. Calculations are given as examples.

* * *

The Use of Maleic Hydrazide for Beet Storage. H. WENZL and R. KREXNER. *Zucker*, 1957, **10**, 309–313. The spraying of beet leaves before harvesting with maleic hydrazide as a means of checking leaf growth and so reducing sugar losses is discussed. Experiments using various preparations have been carried out since 1951 and the results of these are compared. Two preparations, "Betan T" and "Betan N", were used, the former containing 25% MH-triethanolamine salt and 12·5% pure MH, the latter containing 15% MH-sodium salt and 10·6% pure MH. The beet was stored for 64 days after harvesting. The results are tabulated and show only a moderately favourable effect, which is in agreement with the results of other experiments. However, only a one-third reduction in sugar losses could be obtained in contrast to an occasional reported reduction to one-tenth sugar losses. Difficulties encountered in the use of MH include: (1) the effect of inclement weather conditions (rain within 4 hr of spraying will wash the substance away); (2) it is not practical to store sprayed beet for longer periods and at the same time process unsprayed beet as quickly as possible. Both reasons make the use of the relatively expensive MH unprofitable.

Diffusion Juice Production. 1. Mechanical Diffusion—Some Criteria. V. VALTER. **2. Diffusion with Restricted Mixing of Cossettes.** V. VALTER. **3. Diffusion with Unrestricted Mixing of Cossettes.** K. CÍZ. **4. Microbiology of Juice Production.** M. DRACHOVSKÁ. **5. Juice Production—Suggested Controls.** M. DRACHOVSKÁ and K. SANDERA. *Listy Cukr.*, 1957, **73**, 145–154. —Various types of diffusers and diffusion processes are reviewed as are the problems of bacterial infection and control. Thirty-five references to the literature are given.

* * *

Mycoflora of Stored Beet at Zidlochovice Sugar Factory in the 1956 Campaign. Z. CACA and J. NOVOTNY. *Listy Cukr.*, 1957, **73**, 155–156.—Beet was stored for 31 days in three 2 m high piles, each containing 100 tons of beet. One pile was the control, one was sprayed with VK chalk (0·5% by wt. of total beet), and the third was limed. Full details are given of the daily air temperatures and of the temperatures inside the piles. Of the mycoflora identified, *Cladosporum herbarum* (Pers.) Link. and various species of *Penicillium* were in greatest numbers. Spraying with VK chalk and lime reduced infection and altered the mycoflora distribution.

* * *

Efficiency and Costs of Biological Purification of Sugar Factory Waste. K. SKALSKI. *Gaz. Cukr.*, 1957, 59, 181–184.—Results of waste water purification using the Nolte method[2] of B.O.D. reduction are discussed. The waste water was found to be too acid after treatment to irrigate fields, but with proper application the method is considered good, and costs are low.

* * *

Results of the Work of Sugar Factory (Molasses) Recovery Sections During the 1956/57 Campaign. E. A. MOGIL'NYI. *Sakhar. Prom.*, 1957, (8), 14–19.—The performance of Russian separation plants using the saccharate processes for sugar recovery from molasses is reviewed. Difficulties and causes of inefficient operation are discussed and the American method of calculating sugar losses in the separation sections described.

* * *

Use of a Tower Diffuser at Kshen' Sugar Factory. I. I. PRILUTSKII. *Sakhar. Prom.*, 1957, (8), 22–25.—The operation of a tower diffuser of Russian design at Kshen' is described with the aid of a flowsheet. Cossettes, weighed on a continuous band weigher, are mixed in a preliminary scalder with hot diffusion juice and heated to 38–40°C. They then go to the main scalder where they are mixed with circulation juice and heated to 90–92°C. Part of the juice is returned from the diffuser to the main scalder and the remainder to further processing via the preliminary scalder. The speed of rotation of the screw conveyor

[1] *I.S.J.*, 1957, **59**, 50.

[2] *Investigation of the Nolte fermentation system of water purification*, Sugar Industry Institute, Warsaw, 1955.

is within ranges of 0·85–1·3 and 1·72–2·6 r.p.m. corresponding to capacities of 155–193 and 218—(*unstated*) metric tons per hour.

* * *

Electrolytic Treatment of Beet Slicer Knives. C. F. DRONOV. *Sakhar. Prom.*, 1957, (8), 27–30.—Electrolytic polishing of new knives is advocated to improve cossette quality. The knives are immersed in an electrolyte (65% phosphoric acid + 15% sulphuric acid + 6% chromic acid + 14% water, all by weight) for 4–7 min at a temperature of 65–70°C and 9–10 volts. Corrosion resistance is further increased by immersing the knives for 10 min in a 10% solution of caustic soda at 70–80° after the electrolytic treatment. Results are promising, though further tests are to be made to give fuller details of advantages.

* * *

Knife Frame for Cutting Beets into Laminar Cossettes. N. A. BURENKOV and V. A. ZADNEPRYANYI. *Sakhar. Prom.*, 1957, (8) 39–41.—The knife frame described produces flat cossettes instead of furrow-shaped cossettes as does the Chizhek type generally used in Russia. The essential parts are : a set of plates mounted on a shaft and separated by washers for longitudinal cuts in the beet, and a flat blade facing the plates which cuts the beet strips to a required thickness. The average length of cossettes is 17·7 m per 100 g Settings of the blade and plates may be altered during operation.

* * *

Betaine in Beet and Sugar Factory Products. E. SOMMER. *Zeitsch. Zuckerind.*, 1957, **82,** 330–331.—Quantitative determination of betaine in different varieties of beet was carried out by separating proteins from press juice by alcohol precipitation, and precipitating betaine with ammonium reineckate. The precipitate was dissolved in acetone and the salt determined colorimetrically. The betaine content of ripe beet roots varied from 0·07 to 0·30%, and was less than in the leaf. Investigation of the betaine distribution in the root showed the greatest amounts to be in the top and the tail. Betaine-N averaged 14% of the total N in the root. Further investigations showed that in the 1955/56 campaign approximately 99% of the original betaine content of the beet was found in the molasses, in 1956/57 the amount being just over 92%.

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Press Cake Drying. A. SCHWIETER. *Zeitsch. Zuckerind.*, 1957, **82,** 341–342.—Press cake at the Friedberg factory is dried by an oilfired turbo-dryer which was developed (outside Germany) from a Büttner turbo-dryer. The upper part comprises a revolving grate, while the lower part has a ring plate frame, several fans rotating inside these sections to circulate warm air axially and radically over the cake. The partially dried substance is split up by intermediate disintegrators to increase the surface exposed. At the end of the cooling zone a crushing mill grinds the material to hazel nut size, and it then passes via a hopper to paper bags. Ten tons per hour of mud, pneumatically fed, is dried from 50 to 8% moisture content, by evaporation of 4,550 kg water. Power requirement is 40 kW including that of the gas circulation blowers. Corrosion by SO_3, arising from the high sulphur content of the oil, is avoided by blowing lime dust in with the air for combustion. The furnace walls are cooled by low temperature warm air introduced through louvres. Heating of a similar drying plant under construction at another factory is by means of a travelling grate, which acts as a zone grate, and a cool air blower is incorporated.

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Juice Scheme Models. F. CECIL. *Zeitsch. Zuckerind.*, 1957, **82,** 394–403.—Calculations are given for material flow in different schemes of operation of both raw and white sugar factories. Ten examples are given in order to demonstrate the use of these calculations.

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Investigation of the Olier Continuous Diffuser in Poland. W. ZERO, Z. ZAREBA, and J. HASZCZYNSKI. *Listy Cukr.*, 1957, **73,** 169–176.—An Olier diffuser with a daily capacity of 1200–1500 metric tons, which was installed at Przework factory in 1956 is described with the aid of diagrams and photographs. Performance data are compared with those of a Roberts battery diffuser operating at the same factory. Neither of the diffusers operated normally. Juice quality was about the same, sugar losses being 0·486% on beet in the Olier and 0·504% on beet in the Roberts diffuser. Draught is recorded as 125·1 in the Olier without using return water (126·3 with return water) and 108·2 in the Roberts.

* * *

Beet Pulp Water Return at Modrany Sugar Factory During the 1956/57 Campaign. J. GEBLER and J. VOTAVA. *Listy Cukr.*, 1957, **73,** 185–190.—Diffusion and pulp-press water, mechanically pre-purified in a Scheibler pulp-catcher, was returned to the last diffuser without heating or disinfecting, fresh water being introduced only as make-up. A high temperature was maintained through the diffusion battery commencing with a second diffuser from the water end, and, despite the working of deteriorated beet, there were no snags in operation. Increased bacterial activity in the battery was attributed not to the return water but to the low quality of the beet. Results of tests with return water compared favourably with those using fresh water.

* * *

D.d.S. Diffuser. J. PODHORODECKI. *Gaz. Cukr.*, 1957, **59,** 197–201.—Constructional details of the D.d.S. diffuser are given together with several diagrams, and its performance in certain Danish and French factories reviewed.

* * *

Properties and Processing of Frozen Beet in Sugar Production. F. SCHNEIDER. *Zucker*, 1957, **10,** 375–383. —The microbial infection of frozen beets from the 1957 campaign is discussed with the aid of photo-

graphs, and paper chromatograms are given (in colour) of the slimy substances and sugars from the beet juices. Also in colour are the photographs of juice samples from both healthy and frozen beet. Beet stored for 4 months (from mid-November to March) yielded a raw juice of 90·5 purity and pH 6·0, the invert sugar of which was somewhat increased. The purity of raw juice from frozen beet was from 83·9 to 32·3 according to the extent of damage, while the pH was 6–4·1. Conductivity increased considerably, resulting from an increase in ash content from 3·2 to 6·8%. Reducing sugars especially increased, reaching 1% in the stored beet. The thick juice from the stored beet had a purity of 94 despite storage under the same severe conditions Crystallizable thick juice of purity somewhat below 80 was extracted from the deteriorated beet, while the almost black thick juices from the greatly deteriorated beet showed hardly any effect of purification, because of degradation during liming The limit in practice of raw juice purity is 80 and pH 5, after which practically no appreciable amounts of sugar can be recovered. Steps to be taken in the processing of damaged beets are discussed.

* * *

Choice of Press for Pulp Pressing. N. N. SEMENOV and A. K. NAIDENOV. *Sakhar. Prom.*, 1957, (9), 21–24.—Performance tests of three types of horizontal presses have shown that the screw press at Pivnenkovskii factory, a diagram of which is given, is the most efficient. This incorporates a conical screw with perforated blades which revolves at 15 r.p.m. and works 1100 tons of pulp per day. The pressed pulp contains 10–12% dry solids. Certian defects are noted. An experimental inclined press of the authors' design is described and illustrated diagrammatically.

* * *

Requirements in the Installation of Twin Diffusion Batteries. G. M. GERUS. *Sakhar. Prom.*, (9), 24–25.—The most frequent cause of faulty performance of two diffusion batteries operating in parallel is the use of one condenser water pump for both batteries. Greatest efficiency can be attained by installing separate washers, elevators, weighers, slicers, cossettes conveyors, and condenser water pumps for each battery, and the batteries should have the same capacity.

* * *

Rapid Highly-Productive Beet Slicing. P. S. SICHEVOI. *Sakhar. Prom.*, 1957, (9), 26–29.—Analysis of performance data of existing slicers shows that they operate at only 40–60% of theoretical efficiency because of insufficient pressure at low cutting speeds. The use of knives designed by the author increase the cutting speed to 10–11 m/sec, thereby increasing efficiency. The use of a 90 kW motor, operating at 1500 r.p.m., is advocated for a slicer incorporating the knives.

* * *

The BMA Improved Single-Tower Continuous Diffuser. ANON. *Sakhar. Prom.*, 1957, (9), 67–74.—A detailed description of the BMA tower diffuser is given with illustrations, diagrams, and tabulated operating data.

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A New Method of Juice Purification in Beet Sugar Production. ANON. *Sakhar. Prom.*, 1957, (9), 74–75.—The BMA technique is described, whereby diffusion juice is limed in three stages (totalling about 1·1% by weight of beet), the pH and temperature being progressively raised from 9–10·5 (8–8·5 for stale beet) to 10·8–11 and from 60 to 85°C respectively. After thickening and vacuum filtration, the juice is treated with milk-of-lime (0·4% CaO by weight of beet). It is then heated to 102–105°C, gassed with CO_2 to pH 9, after which the thin juice (95–96%) passes to the 2nd thickeners and then to the evaporators, while the mud (4–5%), consisting almost entirely of pure $CaCO_3$, returns to diffusion. With this new method a coefficient of filtration of 1·0–2·5 and a settling rate of 10–25 cm/min are possible.

* * *

The Influence of Cations on Sucrose Solubility in Molasses and the Possibilities of their Different Solubility Influences. G. QUENTIN. *Zucker*, 1957, **10**, 408–415.—Investigations of the effect of various substances on the solubility of sucrose in molasses are discussed with 28 references to the literature. Beet B-molasses was treated with a polystyrene-based cation exchanger, and the cations of aliquots were replaced by Li, Mg, K, Na and Ca cations, and the increased sugar recovery given for molasses diluted to 60% and 75%. Factory trials were carried out during the 1955/56 campaign, when about 25% of the cation equivalents were replaced by Mg, the exchange rate being increased to 40% in a later series of strikes. The mean results from 21 strikes show an increased purity drop in the final molasses, most of this occurring in the crystallizers. The Mg-containing massecuite was easily centrifuged, although nothing exceptional was noted in affination of the sugar. No changes were found in the colour of the Mg-massecuite or in the ash content of the refined sugar. A plant was set up for the treatment of all 1956/57 campaign B-molasses. The purities of the molasses from the 4 campaigns 1953–56 are shown graphically. The purity of the molasses from 1956 was 3·1 units lower than that of the previous campaign and 3·6 units lower than the average of the previous 3 campaigns. Average exchange was about 20%. Ion-exchanger sweetening-off water was obtained to the extent of about 20% on molasses. Some was used to wash the B- and C-product crystals, while the remainder was boiled with the start of a new strike. The installation of a small evaporator is advocated for the next campaign. Analysis of the costs show that the process adopted is economical even with relatively high payment for molasses as fodder. With a drop in the payment for molasses an increase on the exchange percentage from 20 would be economically possible and would substantially increase sugar recovery. The process compares very favourably with the saccharate process.

Tate & Lyle Times—Visitors Edition. 112 pp ; 5¼ × 7¼ in. (Tate & Lyle Ltd., 21 Mincing Lane, London E.C.3.). 1958.

This, the third edition of the visitors handbook, provides a fully illustrated guide to the whole of the Tate and Lyle organization and its activities, together with articles of general interest describing the history of sugar, the cane, the beet, sugar supplies and prices, sugar in the diet, etc. But the majority of the book is devoted to the three Tate and Lyle refineries and coloured drawings show the layout of each. Their histories, the process used, sugar packeting, opportunities for their workers, special packs and customers are mentioned, and an account is given of the John Walker & Co. Ltd. refinery at Greenock and the research establishment at Keston.

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The Australian Sugar Year Book 1958. 600 pp ; 7¼ × 9¾ in. (The Strand Press Pty. Ltd., 236 Elizabeth Street, Brisbane, Queensland.) 1958. Price : 30s. 0d.

The familiar layout is continued in the latest edition of this year book of the Australian sugar industry. The "Sugar Industry Directory" lists the names and addresses of officials of the groups and organizations of the industry—Agricultural bank, cane pest and disease control boards, cane testers, cane growers, etc.—while the "Sugar Year Newsreel' provides a digest of the events of 1957 of importance to the Australian industry. An article inserted by the A.S.P.A. and the Australian Cane Growers' Council gives a "bird's eye view" of the Australian industry and contrives to compress a great many descriptive facts in a short space. In "Sugar Statistics" appear data on the 1957 crushing season both from the individual mills, and on a national basis. Developments over the year are reviewed in "The Australian Sugar Industry," contributed by the Head Office Staff of the Australian and Queensland Cane Growers' Associations. Accounts are given of the 1957 Conferences of the latter Association, the A.S.P.A., and the N.S.W. Cane Growers' Association. A number of articles describe the work of the Bureau of Sugar Experiment Stations, the Queensland Society of Sugar Cane Technologists, Queensland Sugar Research Institute, etc., as well as the bulk loading installations at Mackay and the bulk sugar reception at C.S.R. refineries.

Once again, the Year Book contains a large section describing the Australian sugar mills and districts with detailed accounts of the equipment, etc. and crop records for a number of years. Each is plentifully illustrated with numerous photographs and maps, as is the whole of the book. The book supplies an up-to-date reference work for the whole Australian industry and is likely to contain every fact required by a reader. The only disappointment, and this a minor one, is that the photograpns at the front and back of the book are printed in a light brown colour on white which makes them difficult to see clearly.

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Annual Report, Department of Agriculture, Mauritius, 1955. 108 pp; 6×9¾ in. (Government Printer, Mauritius). 1957.

A record production of sugar was obtained during the year in spite of a lower harvested area and lower yield per acre than in the previous year. Climate, varietal changes and increased factory capacity allowing the crop to be handled at time of optimum maturity are given as the main causes for this result.

Detailed investigation is made by the Sugar Industry Research Institute, in its third year of independent existence; but what may be termed extension work where a considerable proportion of the cane is grown by peasants remains in Departmental hands, a rough dividing line being the 100 acre unit. Hot water treatment has brought under control chlorotic streak and the Institute is engaged in working out a similar treatment for ratoon stunting disease. The presence of Fiji disease in Madagascar constitutes a definite threat and the resistance of Mauritian varieties is being tested in Madagascar.

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The World's Sugar—Progress and Policy. V. P. TIMOSHENKO and B. C. SWERLING. 364 pp; 6×9in. (Stanford University Press, Stanford, Calif., U.S.A. : Oxford University Press, Warwick Sq., London E.C.4.). 1958. Price: 52s 0d.

This study is one of Stanford University Food Research Institute's series on the complex aspects of food agriculture and World War II. It deals with the developments before, during and after the war and is in three parts. The first is an introduction to general inter-commodity competition and to sugar supply, with attention to the international control of sugar and the effect of the war. The second part is concerned with development in beet and cane agriculture and the advance in social organization which accompanied the modernization of the industry. The third section provides a detailed discussion of sugar policy in peace and war with chapters on the U.S.A., the U.K., continental Europe and the U.S.S.R. The free raw sugar market and the effects of the International Sugar Agreement of 1953 are considered.

Laboratory Methods and Chemical Reports

The Activity of Ions. S. TRAUTMANN and L. AMBARD. *J. Chim. Phys.*, 1956, **53**, 389–392; through *S.I.A.*, 1957, **19**, Abs. 470.—The rate of hydrolysis of sucrose in solution by HCl increases in proportion to the sucrose concentration, but the increase, with increase of HCl content, is greater than in proportion to HCl concentration. In the presence of increasing amounts of NaCl, the rate of hydrolysis increases very much more than can be accounted for by the increase of sucrose and HCl concentration due to reduction in effective solvent volume by the molecular volume of the NaCl. The addition of a non-electrolyte such as glycerol to a sucrose solution does not affect the rate of hydrolysis. It is therefore suggested that the hydration of the Na cation reduces the hydration of the H^+ ion and that the H^+ ion is more mobile when less hydrated and hence has greater activity. Tests of sucrose hydrolysis in the presence of KCl, NaCl or LiCl show an increasing rate of hydrolysis with the salts in that order; this is the same order as that of the known increasing hydration of the cations, which confirms the above hypothesis. It is likewise postulated that with increasing concentration of HCl (alone) the H^+ ions will be less hydrated and hence have greater activities.

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Binding of Calcium Ions by Adsorbed Protein in Cane Sugar Juice. M. C. BENNETT. *Chem. & Ind.*, 1957, 1098–1100.—A technique is described for determining the dissociation constant of the Ca^{2+}-protein complex and these calculated for pH values of 3, 4 and 5. The values are in accordance with the view that the adsorbed proteinaceous material in cane juice behaves as a conjugated system (mucoid) containing both protein and mucopolysaccharide.

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Determination of Moisture in Sugars with Infra-Red Rays. K. NISHIKI. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1956, **5**, 23–33.—A 70–80 volt 250 watt infra-red lamp was used in a drying box to remove moisture from sugar and sugar solutions. Results were well in accord with those obtained by vacuum oven drying, but the time necessary was reduced from 3–4 hr (oven) to 20 min for a 2 g sample of crystal sugar or 50–60 min for a 1 g sample of sugar solution sprinkled on about 3 g of quartz and dried in a layer less than 5 mm thick.

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Physico-Chemical Study of Beet Juice Purification. V. Determination of the Electrokinetic Potential of Suspensions of Turbid 1st Carbonatation Juice. R. KOHN and J. VASÁTKO. *Listy Cukr.*, 1957, **73**, 159–163.—The ζ-potential of the mud particles was determined for juices ranging in alkalinity from 0·130% CaO to 0·006% CaO, and was found to be negative in all cases, increasing numerically with decreasing alkalinity to a maximum $\zeta = -10{\cdot}3$ mV at a 2nd carbonatation alkalinity of 0·023% CaO. The mean potential of the heaviest particles (mainly $CaCO_3$) separated from the turbid juice by centrifuging was –4·8 mV. The potential of $CaCO_3$ crystals suspended in carbonatation juice and of $CaCO_3$ particles prepared from carbonatated juice was determined on the basis of catophoresis and electro-osmosis. In both cases the potential was negative. It is concluded from the series of experiments that the $CaCO_3$ particles formed in carbonatation juices have an initial positive potential, but after adsorbing numerous organic non-sugars, colouring matter, lime salts of organic acids, etc., or forming mud aggregates with precipitated colloids, their final ζ-potential is negative.

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Starch Content in Raw Sugars. A. IINUMA. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1956, **5**, 72.—A survey of raw sugars showed that Taiwan (0·06–0·123%) and Australian (0·07%) have much more starch in them than sugar from other sources. The starch is not removed in the refining process and consequently may be detected in refined sugars. Difficulty was met with in refining starch-rich sugars.

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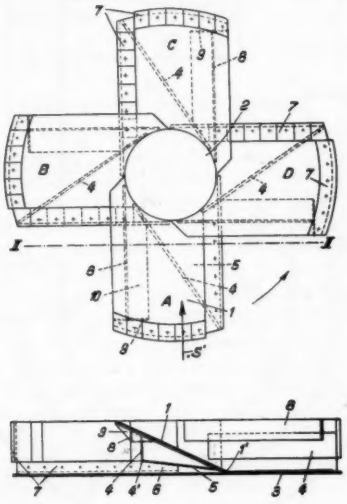
The Ash of Raw Sugar (2nd Report). *Technical Report* (Sugar Research Institute, Queensland), 1957 (43).—Investigations were made of the quantity and composition of the ash of affined raw cane sugar from 23 mills. The ash content of the washed crystal varied from 0·038 to 0·137%. The quantity can be correlated with the soil and climatic conditions associated with crop production, being lowest in the high rainfall districts, and highest in areas of low rainfall, and where irrigation is practised. Major ash constituents are potassium, calcium and sulphate. In an attempt to explain the mechanism of co-crystallization of these impurities with sucrose, it would appear that Fe and Al exist mainly as phosphate; K as chloride or as double sulphate with $CaSO_4$; Ca and Mg as aconitate and Ca also to some extent as phosphate in certain cases. It is concluded that with the normal lime defecation process, little can be done to reduce the ash content of the crystal; total ash in shipment raw sugar is a function of the total ash of clarified juice and the polarization to which the shipment sugar has been washed.

UNITED KINGDOM

Cossette Distributor for a Tower Diffuser. BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT, of Braunschweig, Germany. **786,606.** 19th January 1956; 20th November 1957.—The distributor consists of four plates 1 mounted at an angle to the horizontal at intervals around the central shaft 2, to which they are coupled through a clutch mechanism. The bottom, leading edge 1′ of the plate sweeps over the



screen 3 through which passes the diffusion juice. A guide plate 4 is attached to the underside of the distributor plate 1, and the bottom of this guide plate (4′) is connected to 1′ by a triangular plate 5 which rises away from the screen 3 as it goes nearer the central shaft, leaving a wedge-shaped space beneath. The part of plate 1 which projects beyond plate 4 is stiffened by means of plates 8, 9 and 10, while scrapers 7 are fitted to the leading and outside edges of plates 1. Beet cossettes entering the tower in the direction of the arrow *S* will thus be directed by guide plates 4 so that they impinge on the following distributor plate 1 instead of collecting underneath plate 1 as formerly.

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Clarification of Sugar Juices (with Polyelectrolytes). MONSANTO CHEMICAL CO., of St. Louis, Mo., U.S.A. **787,127.** 17th March 1954; 4th December 1957.—Cane or beet juice is treated with 1 to 100 p.p.m. of a water-soluble synthetic polyelectrolyte of M.W. at least 10,000. The polyelectrolyte may be a polycationic linear polymer or co-polymer containing a number of tri- or pentavalent nitrogen atoms in the cation; alternatively, it may be a polyanionic linear polymer or co-polymer having a number of carboxyl or carboxylic acid salt groups, e.g. a co-polymer of vinyl acetate with maleic acid or a partial ester of maleic acid, or a calcium salt of one of these. It may be a co-polymer of iso-butylene with the ammonium salt of the half-amide of maleic acid or, alternatively, an alkali metal or calcium salt of a hydrolysed polyacrylonitrile.

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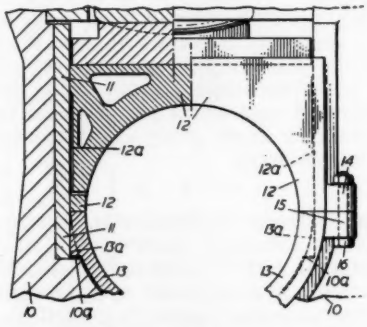
Top Roller Journals for Sugar Cane Mills. GEORGE FLETCHER & CO. LTD. and C. W. MURRAY, of Derby. **788,719.** 29th September 1956; 8th January 1958.—The top bearing brass 12 of a top roller journal possesses lugs 14, which are connected with the corresponding lugs 15 on the bottom bearing brass 13 by means of a bolt 16 which joins the two brasses firmly so that upward movement of the top roller



does not separate them, the oil film remains intact and juice does not penetrate the journal. The brasses are formed with flat side faces 12*a* and 13*a* which fit between the faces of the headstock 10 and wearing plate 11 so as to provide additional bearing surfaces for the outer side of the bearing and helping to prevent tilting of the brass in the headstock jaw, formed by the shoulders 10*a*.

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Evaporation and/or Boiling of Aqueous Sugar Solutions. THE GEIGY CO. LTD., of Rhodes, Middleton, Manchester. **789,744.** 23rd January 1956; 29th January

Copies of Specifications of United Kingdom Patents can be obtained on application to H.M. Patent Office, 25 Southampton Buildings, London, W.C.2. (price 2s each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C. (price 25 cents each).

1958.—An anti-foam agent for use in boiling sugar solutions comprises a mono- or di-ether or mono- or di-ester of a polyalkylene glycol of molecular weight 200–3000 (a polyethylene glycol of M.W. 200–1000 or a polypropylene glycol of M.W. 1000–3000) with a non-hydroxylic aliphatic monocarboxylic acid (stearic acid), to be added in a proportion of 1 : 100 p.p.m.

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L-Glutamic Acid from a Solution obtained by Alkaline Hydrolysis of Pyrrolidone Carboxylic Acid. N.V. CENTRALE SUIKER MIJ., of Amsterdam, Holland. **790,602.** 13th August 1956; 12th February 1958.—A solution containing L-glutamic acid is obtained by alkaline hydrolysis of beet wastes, e.g. vinasse, and is rapidly adjusted to pH below 7 (4–6) by adding to a solution of a strong acid while stirring. The salt thus formed is filtered off and the filtrate adjusted to the iso-electric point of L-glutamic acid.

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Ion Retardation Method of Separating Solutes (Sucrose and Ionized Salts). DOW CHEMICAL CO., of Midland, Mich., U.S.A. **790,897.** 29th June, 1956 ; 19th February, 1958.—Separation of a sucrose-salt solution into sucrose-rich and salt-rich effluent fractions is effected by passing the mixture through a bed containing a reactive form of a solid amphoteric ion exchange resin ; following this with passage of water, then more mixture and so on alternately. The resin is in the form of granules of an insoluble composite body of at least two intimately associated solid resin ingredients including an insoluble cross-linked resin and a normally water-soluble resin ingredient which is rendered insoluble by the cross-linking effect of the other ingredient. One of the resins contains anion exchange groups and is present as 0·3—3 chemical equivalents per chemical equivalent of the cation exchange group contained by the remaining ingredient(s).

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Production of Betaine Hydrochlorids. INTERNATIONAL MINERALS & CHEMICAL CORP., of Chicago, Ill., U.S.A. **791,146.** 15th November, 1955, 26th February, 1958.—Betaine hydrochloride and inorganic salts are removed from beet wastes (e.g. Steffen's filtrate) by adjusting the pH to below 1·0 and, e.g., concentrating to a specific gravity of 1·2—1·5 (1·35—1·5). On standing, the betaine hydroshloride and salts crystallize out and the whole is subjected to centrifugal action, whereby the inorganic salts collect at the bottom of the liquid phase and the betaine at the top, whence each can be separated.

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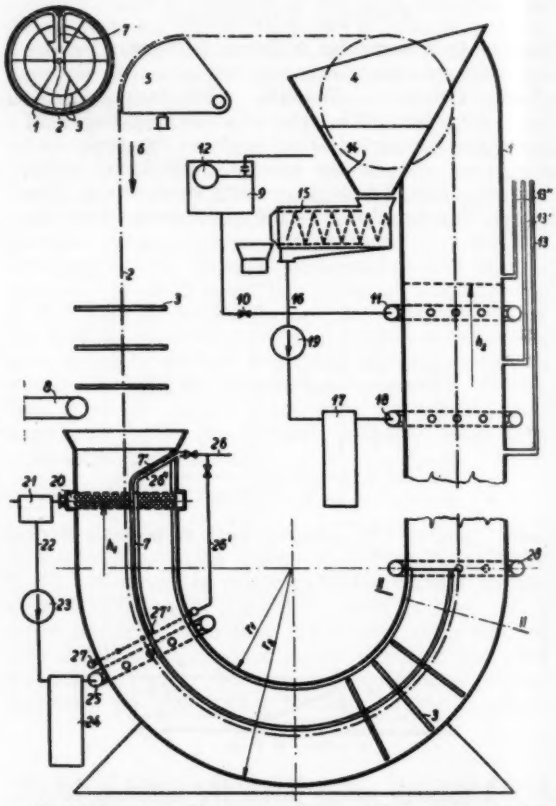
Extracting Sugar from Sugar Beet Cosserres. "LICENCIA" TALÁLMANYOKAT ERTÉKESITÓ VÁLLALAT, of Budapest, Hungary. **792,156.** 23rd August, 1955; 19th March, 1958.—A conveyor chain 2 carrying conveyor bars 3 is located in the axis of the J-shaped diffuser 1. The chain is moved by a sprocket wheel 4 and through a tensioning device 5 in the direction of arrow 6. In the pipe bend the conveyor lies on a guide path 7 extending also to the shorter limb of the diffuser and ending in the oblique part 7'. Fresh cossettes are introduced on conveyor belt 8 which projects into the spaces between the conveyor bars so that the vessel is uniformly filled with cossettes. Fresh water flows out of tank 9 through a regulating valve 10 and through an annular distributor 11 into



the diffuser. Glass pipes 13, 13' and 13" indicate the level of liquid. The mouth 14 is disposed above a cossette press, and press water from this returns to the diffuser through pipe 16, heater 17 and distributor ring 18, under the action of pump 19. Raw juice is withdrawn through annular chamber 20 having a perforated inner wall into tank 21. Some juice is returned to the diffuser through pipe 22, pump 23, preheater 24 and annular pipe 25. Scalding to 75–80°C is carried out by introducing steam either through distributors 27, 27' or 28 supplied from pipe 26.

The pipe bend has such a large radius of curvature that the cossettes are not subjected to large mechanical stresses ; to effect this the radius of the outer arc (r_2) is smaller than 3 times (preferably twice) the inner arc radius r_1. The diffusion vessel is so dimensioned and the operation so regulated that extraction is effected to a degree determined by economic considerations. For a given cossette quality, the diffusion time and extraction can be regulated by adjustment

of the speed of the conveyor chain, the water level in the longer limb of the diffuser, and also of the amount of raw juice recycled. The diffuser can deal with very thin cossettes of specific length greater than 15 metres per 100g (25–30 m/100g). An alternative form of diffuser has conveyor bars in the shape of rectangular frames with traverse chains, in this case guided by two conveyor chains let into grooves formed in the diffuser.

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Glutamic Acid (from Beet Waste Liquor). INTERNATIONAL MINERALS & CHEMICAL CORP. of Chicago, Ill., U.S.A. **791,968.** 29th August, 1955 ; 19th March, 1958.—Beet waste liquors (concentrated Steffen's filtrate or its alkaline hydrolysate) at a pH greater than 7 (9–11) and a dissolved solids content greater than 25% (40%), are treated with a water-soluble inorganic barium compound (barium chloride) to precipitate organic impurities ; glutamic acid is recovered from the treated liquid.

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Granular Adsorbent for Sugar Refining. BAUGH & SONS CO., of Baltimore, Md., U.S.A. **792,137.** 22nd November, 1955 ; 19th March, 1958.—A heat hardened granular adsorbent material is formed from a homogeneous mixture of 60–80% by weight of steamed bone meal, about 15–20% of clay (Attapulgite) and about 20% of carbonizable organic organic material which mixture, containing 44–48 pounds of water per 100 pounds of solids is plasticised and extruded into suitable shapes before drying and firing in the substantial absence of air to harden them at a temperature below that at which the clay vitrifies. The granules produced have substantially more pore volume in the range of pore radii 75–150Å and have improved decolorizing power for sugar liquors compared with either bone char or basic calcium phosphate-based synthetic adsorbents.

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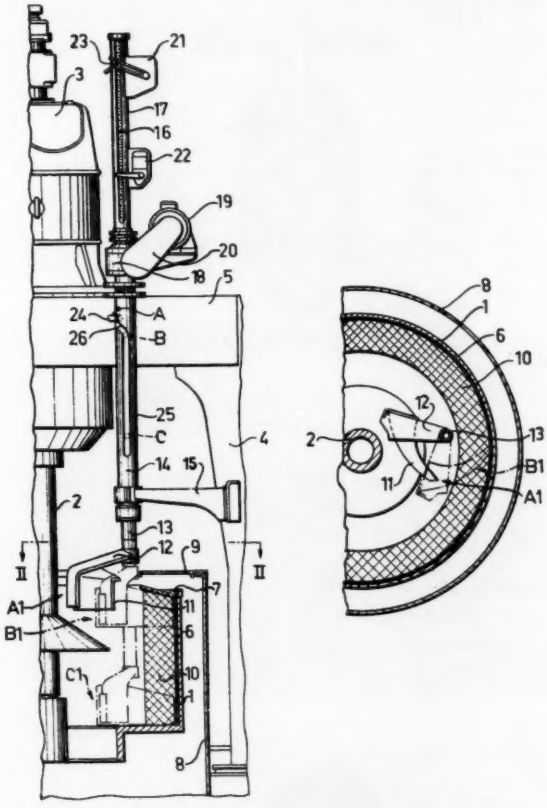
Purification of Sugar Solutions. DOW CHEMICAL COMPANY, of Midland, Mich, U.S.A. **792,284.** 3rd May, 1956 ; 26th March, 1958.—An ion exclusion technique is claimed which is carried out at 25–80°C and where the volume of crude sugar solution applied is not greater than the volume of water absorbed within the resin particles (60–80% v/v) and the eluting water volume is at least as much. The resin may be either a cation exchanger formed as the acid or potassium salt of a nuclear-sulphonated copolymer of divinyl benzene with a major amount of styrene and a minor amount of *ar*-ethyl styrene ; alternatively it may be an anion exchange resin wherein the functional groups are quaternary ammonium groups attached to a copolymer of divinyl benzene with a major amount of styrene and a minor amount of *ar*-ethyl styrene. The ionized concentrate from the original solution is a substantially sugar-free solution of potassium aconitate, the potassium sulphonate cation exchanger being used..

Centrifugal (Discharging Mechanism). A. B. LANDSVERK, of Landskrona, Sweden. **792,217.** 25th July 1956 ; 19th March, 1958.—Vertical movement of the shaft 13 carrying the discharging plough 11 is powered by an electric motor drive 18,19,20 governed by limit switches, and operating on the threaded upper part 16. Swivelling of the shaft takes place as a result of movement of peg 24 on shaft 13 moving in the slot 26 cut in sleeve 25 surrounding the shaft. The slot is so arranged that when discharging starts, at the proper basket speed, the shoe pivots round



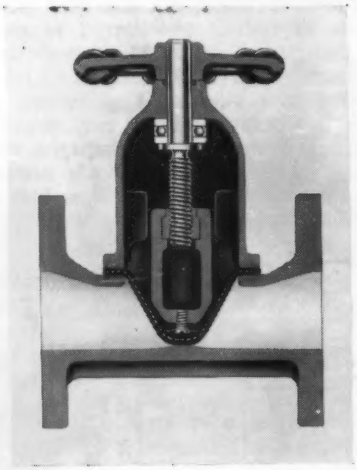
against the basket and then moves downwards, so removing the sugar indicated at 10. The motion is reversed when all the sugar is removed. The discharger shoe 11 is mounted on the arm 12 by means of a spring steel leaf which holds it away from the basket. Engagement with the sugar cake, however, causes the shoe to move against the spring pressure towards the basket wall, and this movement is stopped by means of limit screws mounted on the scraper arm and adjustable so as to ensure protection of the basket screen from damage. To prevent excessive torsional moments on the scraper shaft 13, it is located in front of the radial plane extending through the axis of rotation of the centrifugal and the contact point of the scraper on the inside of the drum, counted in the rotational direction of the drum.

TRADE NOTICES

Statements published under this heading are based on information supplied by the firm or individual concerned. Literature can generally be obtained on request from the address given.

New Saunders Valve. Saunders Valve Co. Ltd., Cwmbran, Monmouthshire.

The new KB straight-through valve permits rodding through to remove accumulated deposits, and functions with minimum flow resistance. It is available



in sizes ranging from ½-inch to 10-inches, and flanged models can be provided, with rubber, glass or lead linings.

* * *

Turbidity Meter. Paterson Engineering Co. Ltd., 129 Kingsway, London W.C.2.

Rapid and very accurate readings are obtainable with the Paterson Turbidity meter, an optical instrument of simple construction which is permanently

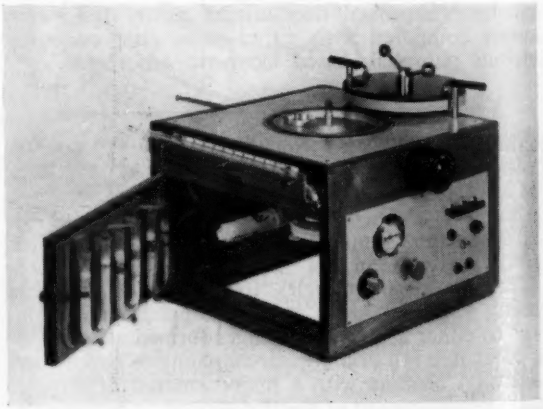
ready for use as it requires no adjustment or preparation of standard solutions. It consists of a vertical ebonite body of one litre capacity, on the back and front faces of which are mounted two mirrors facing each other at a slight angle and protected by aluminium back plates. Each mirror has an aperture, one of these permitting the passage of a ray of light from a lamp of standard strength and the other allowing the opposite mirror to be viewed.

To operate the instrument the ebonite head is removed and a sample of liquid poured in until the mirrors are completely covered. The head is then replaced and when the lamp is switched on, multiple reflections of the light spot are observed in the form of a row of light spots on the mirror face opposite the viewing aperture. The number of spots visible indicate the turbidity of the liquid and to obtain a reading, a slider, actuated by an ebonite knob is moved until it touches but does not obscure the last visible light spot. An arrow on the indicating knob gives a direct reading in units of turbidity on a circular scale. A vertical regulating rod enables the slider to be used as a stirrer, independently of the control knob, so as to prevent inaccuracy due to settlement of suspended particles. The instrument is easily cleaned with the special set of brushes provided.

* * *

Gardiner Precision Vacuum Oven. Griffin & George Ltd., Ealing Road, Alperton, Wembley, Middlesex.

The Gardiner oven was developed in the Tate and Lyle Research Laboratories and was primarily designed for drying such labile products as sugar



syrups and molasses. It incorporates recommendations made at the 1949 Session of ICUMSA to overcome faults inherent in other types of oven, and is now available commercially. The design has been described in detail in the literature[1], and incorporates a circular chamber holding six sample dishes which

[1] *Analyst*, 1953, **78**, (933), 709–711 ; *I.S.J.*, 1955, **57**, 85.

is heated by 12 radial elements to ensure even heating. The chamber is closed by an insulated cover which fits into a recess in the wall of the chamber. A thermostat maintains the temperature to ±1° in the range 90–110°C, and a controlled bleed admits air dried by an activated alumina-barium oxide drying train. Air extracted from the chamber by a vacuum pump passes through a desiccator containing phosphorus pentoxide.

* * *

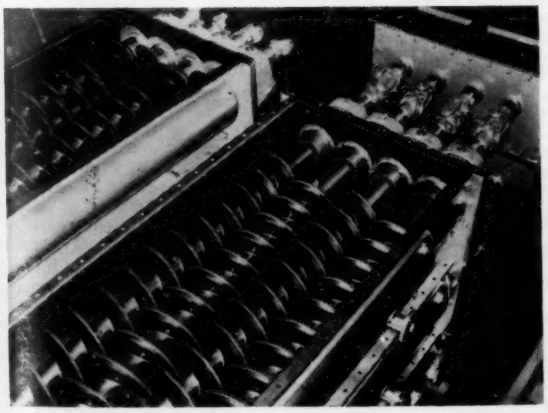
Miniature Glass Electrode. George Kent Ltd., Luton, Beds.

The new minature glass-electrode primary element for the Kent Universal pH recorder is a smaller version of the current model. By using a reproducible single metal-to-metal seal between the electrode unit and the body, the assembly is made completely impervious to water vapour and can be totally immersed in boiling solutions for very long periods, very little maintenance being required. Three varieties of glass electrode cover the ranges 0—14 pH and temperatures up to 100°C., and the assembly can be of the dip type or flow type.

* * *

The "Holo-Flite" Processor. Holdan Engineers (London) Ltd., 119 Victoria St., London S.W.1.

The "Holo-Flite" processor combines two functions —that of a conveyor and that of a heat exchanger. The first is achieved by the use of two or four intermeshing screws which are alternately right-hand and left-hand and are rotated in opposite directions in a trough, at speeds between 1 and 20 r.p.m. The screws comprise hollow flights mounted on a hollow stem pipe ; heat transfer fluid enters at the feed end of the stem pipe by way of a rotary union and passes



along the flight to the discharge end where it is directed into the pipe. It passes along this until it reaches the feed end again and passes out of the equipment via a siphon tube. The trough may be jacketed to provide further heat exchange, and may also be fitted with a dust-tight or vapour dome cover.

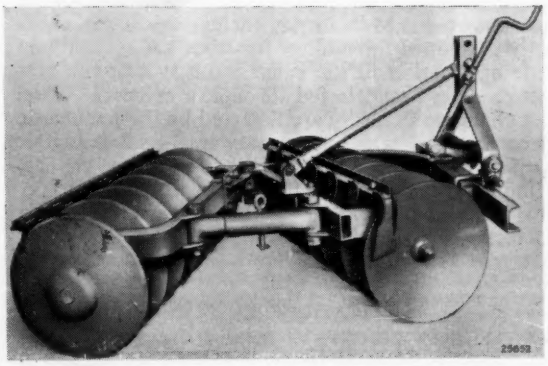
The screws may be of various diameters between 5 and 18 inches, and, with the trough, can be constructed from a range of metals. The "Holo-Flite" technique produces less fines and dust than the method of cooling or heating by air in a rotary shell with cascading material, and further advantages include close control of treatment time and temperature and quantity and temperature of heat exchange fluid.

A number of installations for cooling sugar have been completed in the U.S.A.; the largest cools 30,000 lb per hour from 115° to 95°F, while another cools 6000 lb per hour from 350° to 150°F.

* * *

New Mounted Disc Harrow. Ransomes Sims & Jefferies Ltd., Orwell Works, Ipswich.

A new robustly-designed disc harrow, model THR 3002, has a category 2 headstock and is suitable for use with the Fordson Major, Nuffield, etc. tractor. Its 5 ft 3 in (1·6m) cultivation width makes it most suitable for crops spaced 6 ft (1·8m) apart, and once the harrow is set for work all further adjustments can easily be made without the driver leaving the



tractor seat. Standard discs are of 22 in (55 cm) diameter, but cutaway discs can be supplied if required. The discs turn on hard iron bearings, and the relative angling of the gangs is readily altered between 12° and 21½° by means of a telescopic adjuster. The unit weighs 1045 lb (474 kg) and works to a maximum depth of 8 in (20 cm). Discs are spaced at 9 in (22 cm) and may be provided with scrapers if required.

* * *

Bulk Handling at Huskisson Dock. Stothert & Pitt Ltd., Bath, Somerset.

An unloading and storage installation for bulk sugar at Huskisson Dock, Liverpool put into service by Tate & Lyle, Limited, includes a huge parabolic silo which can hold 100,000 tons of raw sugar, and is served by a conveyor belt system with facilities for weighing and for loading road transport vehicles. Ships are unloaded by four 5-ton electric "Kangaroo" cranes, designed and built by Stothert & Pitt Ltd. Each crane can lift 2½ tons of sugar and has a maxi-

mum discharge rate of 200 tons per hour. The cranes are of balanced-jib level-luffing type with a radius of 75 ft and they discharge into hoppers incorporated in the crane gantries. A short conveyor in each crane then feeds the sugar on to a main conveyor belt along the wharf which serves the rest of the system.

The cranes have a number of interesting features including jibs of welded tubular construction and Ward-Leonard Control Gear, to give high operating speeds with perfect control. The driver's cabin is located on a cantilever arm in front of the crane to give visibility into the ship's hold and the driver works from an armchair seat which incorporates the crane controllers.

An older installation of four Stothert & Pitt slewing cranes which will continue to work alongside the new cranes, brings the total unloading capacity at Huskisson Docks to about 1,000 tons of sugar per hour.

* * *

Transmitting Density Meter. Rotameter Manufacturing Co. Ltd., 330 Purley Way, Croydon, Surrey.

The recently developed transmitting density meter for clean liquids employs the same principle as the well-known "R.M." density meter which was originally developed for milk of lime but has since found wide application in the sugar industry. In the new meter, clean liquid is fed through a spherical vessel and changes of density are detected by the pneumatic force balance which transmits a 3—15 p.s.i. air output signal linearly related to density change. Minimum sensitivity of 0·03 g/ml for full scale deflection is obtainable and working pressures up to 75 p.s.i.g. can be accommodated.

* * *

PUBLICATIONS RECEIVED

TERYLENE IN INDUSTRY. Imperial Chemical Industries Ltd., Imperial Chemical House, Millbank, London S.W.1.

A new 32-page booklet issued by I.C.I. describes their synthetic fibre "Terylene" which is also made under licence in a number of other countries. It is a polymer built up from ethylene glycol and dimethyl terephthalate, and finds application in a wide range of industrial uses where strength, wear- and chemicals-resistance and light weight are required. Numerous photographs show the material in the form of cloth and ropes, etc., in a range of industries, and include use as filter cloth in which form it has found application in the sugar industry.

* * *

D.d.S. PRE-LIMING. Akt. De danske Sukkerfabrikker, Slotsholmsgade 22, Copenhagen K, Denmark.

A new six-page leaflet illustrates the D.d.S. pre-limer, which is available in six different standard sizes covering capacities from 200 to 12,000 tons of beet/24 hr, and which uses the Brieghel-Müller system of progressive pre-liming. The Danish Sugar Co. is manufacturing the equipment and offering plans and drawings for its construction under licence.

* * *

TYPE MC GEARED FLEXIBLE MOTOR COUPLINGS. Link-Belt Company, Prudential Plaza, Chicago 1, Ill., U.S.A.

A new folder, No. 2875, gives details of the new MC couplings designed to transmit electric motor power to pumps, generators, speed reducers, etc.

E-50 AUTOMATIC BAGGING SCALE. Richardson Scale Co., Clifton, N.J., U.S.A.

New Bulletin 3749B describes the design, capacities, method of feed and discharge of the new scale which is suitable for almost all materials packaged in open-mouth paper or textile bags, including sugar, beet pulp, etc.

* * *

HONEYWELL MILLIVOLTMETER CONTROLLERS. Honeywell-Brown Ltd., 1 Wadsworth Road, Perivale, Greenford, Middx.

Wherever process variables can be interpreted as voltages it is claimed that cheaper, safer and more efficient plant operation can be achieved by the use of these controllers which are described in a new leaflet.

* * *

MIRRLEES CANE CARRIER DRIVE. The Mirrlees Watson Co. Ltd., Scotland Street, Glasgow.

An improved drive for cane carriers uses a constant speed squirrel-cage motor direct-coupled to a variable-speed electronically-controlled coupling to a worm reduction gear connected by a single spur gearing to the carrier headshaft. This permits the motor to run at constant speed with the carrier stopped, with surface speed varied for close control of feed to the crushing plant, or with "inching" by repeated starting and stopping.

* * *

MC VIBRATING FEEDER. Link-Belt Company, Prudential Plaza, Chicago 1, Ill., U.S.A.

The new MC (motorized counterweight) vibrating feeder, described in leaflet 2669, comprises a trough and motorized vibrator drive. The vibrator is driven by a motor with a double extended shaft carrying counterweights the unbalanced arrangement of which imparts a straight-line oscillating motion to the trough, lifting the material upward and forward along it, the rate varying with hopper opening, trough slope and drive thrust angle. Capacity is up to 250 tons per hr.

* * *

SMITH TURBINE DRIVES FOR CANE MILLS. A. & W. Smith & Co. Ltd., 21 Mincing Lane, London E.C.3.

The turbines drives illustrated in a new leaflet (T.D. 58) include a 500 b.h.p. single stage unit and a multi-stage turbine with single reduction gear unit ; double-helical double reduction gears with a normal shaft and with a pin-type flexible coupling on the output shaft.

* * *

"PROXICON" LEVEL CONTROLLER. J. Edward Hall (Electrical Engineers) Ltd., Clarence Road Works, Leeds 10, Yorks.

The new "Proxicon" unit is suitable for the remote level control of any free-flowing liquid or solid without necessitating direct contact, has no moving parts, and can be extended up to 3000 ft using standard types of cable.

* * *

DRAGE VISCOMETERS. Short & Mason Ltd., Aneroid Works, 280 Wood Street, Walthamstow, London E.17.

The new Drage viscometers cover the needs of small laboratories up to the complex requirements of industrial systems where automatic control of viscosity is required. They may provide continuous recording, and the laboratory models can be supplied with a portable case.

* * *

ELECTROLYTIC CONDUCTIVITY MEASUREMENT, RECORDING AND CONTROL. Electronic Switchgear (London) Ltd., Works Rd., Letchworth, Herts.

New leaflets are available describing equipment designed for measurement of the conductivity of liquids which flow through one of a series of cells of precisely known volume, with the recording and controlling of the measurement.

Japanese Sugar Imports

Metric tons tel quel

	1957	1956	1955
Australia	111,169	37,291	110,949
Cuba	513,135	591,391	291,795
Dominican Republic	37,255	78,206	18,674
Haiti	5,077	10,663	4,572
Indonesia	38,958	92,299	107,790
Mauritius	10,245	0	0
Peru	98,733	85,341	49,656
Ryukyu	31,005	34,519	30,990
Taiwan	314,562	169,705	333,171
Réunion	0	16,005	0
Mexico	0	6,785	0
Philippines	0	35,874	[1]10,682
Brazil	0	34,068	108,217
Other Countries	1,048	9,213	[1]3,867
	1,161,187	1,201,360	1,070,363

Taiwan Sugar Exports 1955-1957

Destination	1957	1956	1955
	(Metric tons, raw value)		
AFRICA :			
British East Africa	23,115	23,754	—
Sudan	39,001	36,344	—
Total Africa	62,116	60,098	—
ASIA :			
Aden	26,790	17,683	14,247
British North Borneo	8,399	19,398	12,500
Burma	—	6,338	—
Ceylon	34,492	45,551	—
Hong Kong	48,931	32,297	10,138
Iran	118,979	136,845	40,999
Iraq	55,551	40,212	57,154
Japan	329,644	191,934	312,940
Korea (South)	13,580	17,561	12,998
Lebanon	—	—	154
Malaya	87,721	104,844	68,946
Pakistan	20,719	20,878	—
Thailand	4,261	13,315	38,881
Viet-Nam and Cambodia	40,318	22,228	16,471
Total Asia	789,385	669,084	585,428
Other Countries	5,805	3,664	906
GRAND TOTAL	857,306	732,846	586,334

Réunion Production 1956/57.[1]—The sugar output of 208,374 tons in 1956/57 was produced from 1,734,000 tons of cane giving a recovery of 12·01% compared with 11·80% the previous crop. Domestic consumption is about 6000 tons.

* * *

Hawaiian Sugar Strike.—The shut-down entered its fourth month on May 1st. Both labour and management have stated that they can hold out for another six to ten months. Half of Hawaii's quota of 1,110,513 tons of raw sugar may be lost if the strike continues for six months. Favourable weather minimized cane damage during the first three months ; however, dry weather will result in losses as more than half of the acreage is irrigated. Red rot disease has infected a small area on the island of Maui. The C. & H. refinery at Crockett is now operating on foreign raws. The demand for a 25 cents per hour wage increase for a one-year contract is the outward problem causing the strike ; however there have been many years of labour-management problems. The plantation companies offered 4 cents per hour for a one-year contract prior to the strike. Two months later they offered 15 cents per hour for a two-year contract. Both were turned down by the union.

BREVITIES

Erratum.—In the abstract entitled "Some Notes on Inclusion"[2] the first part should have read "Inclusion is the phenomenon whereby molasses is enclosed by a layer of sucrose at some time during crystal growth".

* * *

Bulk Sugar Storage in Hawaii.—Plans for a new $1 million bulk sugar terminal at Kawaihae, Hawaii, to serve Kohala Sugar Company were recently announced. Molasses and aqueous ammonia tanks will also be built at portside, adjacent to the new Kawaihae deep water port, now under construction.

* * *

New U.S. Sugar Refinery possibility.[3]—Puerto Rican sugar producers are reported to be studying the possibilities of constructing a refinery on the East Coast of the U.S.A. Such a project would cost about $10 million but would eliminate the current problem of restricted supplies of Puerto Rican refined sugar.

* * *

Austrian 1957 campaign results.[4]—A record yield of 1,655,459 metric tons of beet was obtained in Austria in 1957 which, in spite of an area smaller than in 1956, was a 24% increase on beet production in 1956. The sugar recovery was 15·45% on beet compared with 14·50% in 1956.

* * *

South African Sugar Experiment Station.[5]—The Director of the Experiment station of the South African Sugar Association at Mount Edgecombe, Dr. A. MCMARTIN has resigned because of ill-health, it is announced. Dr. MCMARTIN joined the Station staff in 1933 and was appointed Director in 1950 in succession to Dr. H. H. DODDS.

* * *

Dutch Refinery Anniversary.—The Wester Suikerraffinaderij, Amsterdam, has just celebrated the 75th anniversary of its founding. The refinery is owned by N.V. Centrale Suiker Mij., and processes 3,300 short tons of raw sugar a week.

* * *

Canadian Beet Crop, 1957.[6]—The 1957 sugar beet crop, estimated at 987,000 tons from 83,911 acres is the fourth largest in the history of the industry. It is expected to supply between 15 and 20% of the refined sugar used by Canadians in 1958. The rated capacity of the seven beet factories in Canada is 1,500,000 tons of beet per year. The three in Alberta and one factory in Manitoba consistently operate at full capacity but the two in Ontario and one in Quebec operate much below capacity largely because of low beet acreages in these provinces. Much research has been carried out on development of mechanical thinners, harvesters, toppers etc., and it is hoped thereby to stimulate interest among growers faced with high labour costs.

* * *

Roumanian Sugar Production.[7]—Official data on the cultivation and production of sugar beet and sugar in post-war years include the following :

	Sugar beet area (hectares)	*Sugar beet production (metric tons)*	*Beet yield (metric tons per hectare)*	*Sugar production (metric tons)*	*Sugar extraction (%)*
1957..	131,400	2,043,200	15·5	185,350	9·07
1956..	139,000	1,518,900	10·9	151,100	9·45
1955..	144,900	2,000,000	13·8	122,850	6·14
1954..	107,200	1,407,800	13·1	93,440	6·64
1953..	112,000	1,300,000	11·6	114,550	8·81

[1] F. O. LICHT, *International Sugar Report*, 1958, **90**, (Supp. 6), 9
[2] *I.S.J.*, 1958, **60**, 142.
[3] *Bol. Ofic. A.T.A.C.*, 1958, **17**, 48–49.
[4] *Zeitsch. Zuckerind.*, 1958, **88**, 198.
[5] *S. African Sugar J.*, 1958, **42**, 333.
[6] *Travers' Circular*, 1958, (604), 71.
[7] F. O. LICHT, *International Sugar Report*, 1958, **90**, (Supp. 10), 7.

BREVITIES

Serck Tubes Ltd.—The London office of this Company has been moved and is now at 60 Trafalgar Square, London S.W.1.

* * *

New Italian Sugar Factory.[1]—In Southern Italy, a new sugar factory in the region of Lokri-Siderno (Calabria), will process beet grown in the Sila and Caulonia areas nearby.

* * *

Taiwan Sugar Production.[2]—The 1957–58 sugar season was completed with a record output of about 920,000 metric tons (presumably raw value) compared with 866,040 and 795,149 metric tons, raw value, in the two preceding years.

* * *

Pakistan Sugar Situation.[3]—The Pakistan Minister for Food and Agriculture recently announced that Pakistan would be able to cover all her sugar requirements in about 5 years. The present requirements are about 190,000 tons, white sugar value, per annum while production during the current season is estimated at about 130,000 tons of white sugar. As a result of this, and also to save much-needed foreign exchange, the Government will cut this year's imports to 60,000 tons compared with 90,000 tons last year. In the first five-year plan 11 sugar factories were to be built. Three factories have been erected in West Pakistan and one in East Pakistan and have started operations. Two further factories are being erected in East Pakistan.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at* 19*th May* 1958)	
Anglo-Ceylon (5s)	11/6
Antigua Sugar Factory (£1)	20/9
Booker Bros. (10s)	21/10½
British Sugar Corp. (Ltd. (£1)	15/3
Caroni Ord. (2s)	3/9
Caroni 6% Cum. Pref. (£1)	17/3
Distillers Co. Ltd. (6s. 8d units)	23/11½
Gledhow Chaka's Kraal (£1)	55/6
Hulett & Sons (£1)	65/6
Jamaica Sugar Estates Ltd. (5s units)	5/–
Leach's Argentine (10s units)	9/3
Reynolds Bros. (£1)	46/6
St. Kitts (London) Ltd. (£1)	48/9
Ste. Madeleine (Ord.) (£1)	25/9
Sena Sugar Estates (10s)	22/–
Tate & Lyle (£1)	53/6
Tate & Lyle Investments Ltd. (5s)	11/10½
Trinidad Sugar (5s stock units)	11/–
United Molasses (10s stock units)	27/6
West Indies Sugar Co. Ltd. (£1)	28/–

CLOSING MIDDLE

New York Stocks (*at* 17*th May* 1958)	$
American Crystal ($10)	33¾
Amer. Sugar Ref. Co. ($100)	28¾
Central Aguirre ($5)	19¼
Cuban American ($10)	23
Great Western Sugar	25¼
South P.R. Sugar	27
United Fruit Co.	47½
West Indies Sugar Corp. ($1)	61¼

Iraq Beet Factory/Refinery.[4]—The Mosul factory[5] in Iraq was opened on the 28th April. It will produce 10,000 tons of beet sugar per year and will refine 25,000 tons of imported raws.

* * *

Japan Beet Campaign Results.[6]—The final result of the 1957/58 beet crop in Hokkaido, Japan, yielded 703,772 metric tons of sugar beet from which 85,727 metric tons of sugar were produced. The beet area was 28,356 hectares.

* * *

U.S. Sugar for Hawaii.[7]—It is reported that as a result of the sugar workers' strike, Hawaiian processors have now no sugar for local consumption, and that the U.S. Department of Agriculture has ordered the shipment of 15,000 tons of sugar to Hawaii in consequence.

* * *

New Factory for Turkey.[8]—The construction of a new sugar factory at Etimesgut, near Ankara, has been agreed upon, according to the Export Services Branch of the Board of Trade. The factory, which will have a capacity in the region of 20,000 tons of sugar per year, is expected to come into production in 1960. Due to increased domestic requirements it is thought unlikely that any further supplies of Turkish whites will be available for export before the new crop.

* * *

New Indian Sugar Cane Research Station.[9]—The Mysore Government is reported to have given administrative approval to the scheme for establishment of a cane research station at the Visvesvaraya Canal area with two sub-stations in Gangavathi and Belgaum. The scheme is to be implemented on a top priority basis and will cost Rs. 111,480 (£8,361). The Indian Central Sugarcane Committee has agreed to share 50% of the cost of staff pay and allowances.

* * *

Indian Sugar Production 1956/57.[10]—Final figures in respect of the 1956/57 crop put production of white sugar at 2,029,000 tons which compares with the previous season's outturn of 1,862,100 tons. The increase was shared between most of the sugar producing states, although in Bihar, Mysore, Orrissa and West Bengal slight reductions were recorded. Although Indian production statistics are usually reckoned on a November/October basis the season actually commenced on 19th August 1956 and continued until the Pugalur factory in Madras ceased operations on 11th November 1957.

* * *

American Sugar Refining Company, 1957 Report.—Raw sugar melted during 1957 declined to 1,815,544 short tons from the 1,944,899 tons of the previous year. This reduction was the result of two principal factors; a decrease in the total cane sugar deliveries in the U.S.A. and a substantial increase in beet sugar marketings as allowed by the Sugar Act. Refined sugar delivered totalled 35,054,421 100-lb bags. The Company's two Cuban mills produced 204,508 short tons of raws, compared with 182,571 tons in 1956. No high-test molasses was produced. All the available cane was ground since the Government of Cuba had lifted its restrictions of crushing; however, the cane supply had suffered from drought so that production was only slightly more than that calculated on the 5,150,000 ton crop originally decreed. Plans for the new Charlestown, Boston, refinery are well advanced and the plant should be in operation in 1960. A feature of the Accounts is the series of coloured illustrations of specially designed road and rail equipment for delivery of bulk dry and liquid sugar to industrial customers.

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[1] *Zeitsch. Zuckerind.*, 1958, **88**, 198.
[2] F.O. LICHT, *International Sugar Report*, 1958, **90**, (Supp. 9), 15.
[3] F.O. LICHT, *International Sugar Report*, 1958, **90**, (Supp. 9), 15.
[4] *Public Ledger*, 3rd May, 1958.
[5] *I.S.J.*, 1957, **59**, 167.
[6] F.O. LICHT, *International Sugar Report*, 1958, **90**, (Supp. 10), 14.
[7] *Public Ledger*, 3rd May, 1958.
[8] C. Czarnikow Ltd., *Sugar Review*, 1958 (354), 89.
[9] *Indian Sugar*, 1958, **7**, 699.
[10] C. Czarnikow Ltd., *Sugar Review*, 1958, (349), 69.